NASA CR-
141471

(NASA-CR-141471) SURFACE ELECTRICAL PROPERTIES EXPERIMENT, PART 1 Final Technical Report (Toronto Univ.) 489 p HC $12.00 CSCL 03B

N75-15070

Unclas
G3/91 06656

Final Technical Report on the Surface Electrical Properties Experiment

report prepared by

The University of Toronto

SEPTEMBER 1974

and submitted to MIT
in fulfillment of the
subcontract on NASA
contract NAS9-11540

Personnel

D.W. Strangway
A.P. Annan
J.D. Redman
J.R. Rossiter
J.A. Rylaarsdam
R.D. Watts

Part I of III Parts

Introduction

This report consists of a series of reports, reprints and preprints that in themselves constitute a self-explanatory record of the work performed by the University of Toronto on the Surface Electrical Properties Experiment. This work may be categorized as follows.

A. Data Handling and Processing

Under the direction of and in cooperation with University personnel, the system for converting the analogue tape data collected on the lunar SEP experiment and during related field trips was designed and constructed. The first section of this report therefore consists of six major sections describing the system and its function.

These are:

1) Surface Electrical Properties
   Mark II Data Acquisition System by G. Wagner of Lockheed Electronics.

   This report describes the final system used in processing the lunar data. This system was modified from an earlier version (Mark I) which was used for processing data from the field evaluation model which had a different data and navigation system format. Complete design and circuit diagrams are included.

2) From Analogue tape to digital tape by J.D. Redman of University of Toronto.

This report summarizes the actual operation of the data acquisition system and shows basically how we proceeded to produce a digitized tape from the analogue tape produced on the moon on the DSEA tape recorder. Discussions of digitizing errors, etc. are presented in this report as well as a detailed analysis of the navigation, the temperature, and calibration and background noise information.

3) Science Data Processing and Digital Processing by
R.D. Watts, University of Toronto

This report describes in detail the process followed in demultiplexing the digital tape. The procedures to test for accuracy, the analysis of repeat digitizations and the mechanisms used for calibrating the final output and reducing the navigation data are included. This includes the proceedures used for producing the final digital tape submitted to NSSDC and shows how the navigation and science data were merged.

4) Apollo 17SEP data processing and Modifications to data on SEP D09
J. Rylaarsdam, University of Toronto

In this report the proceedures used to generate actual plots of the lunar field data from the digital tapes are given and the best data for each frequency plotted versus range in wavelength and range in meters is given.

A correction to the final plots is given in the extra memo describing a smallrange error found in the high frequency data. These plots therefore represent the best estimates we now have of the final recorded field strengths.

5) Comparison of SEP range data and data from the VLBI experiment, by J. Rylaarsdam

During the mission, navigation data was collected both from the Rover on-board system and from earth-based VLBI tracking. These data have been processed and analyzed and show remarkably good agreement.

6) SEP antenna patterns reconstructed from EP-4 turn J.R. Rossiter

Since the vehicle did a complete 360° turn around the explosive package deployed 525 m from the transmitter, an attempt was made to reconstruct the antenna pattern. Unfortunately the sampling interval was small and there was some missing data in the turn so the patterns could not be accurately determined. We expect to improve on this somewhat in the future. In the meantime the components do tend to follow the expected lobe pattern.

B. Theoretical and Model Studies

As a background to the interpretation of lunar and field results we have been involved in a comprehensive

study, theoretical and model, of the magnetic fields surrounding an electric dipole.

1)

by A.P. Annan

This report includes a complete analysis of the various theoretical and computational schemes devised to calculate field strengths. The early work was done by straight geometrical optics. Now however the schemes used involve mode analyses and numerical integrations for single layer cases. Multiple layers can be handled by fast fourier transform techniques. These methods have just now reached the point where they can be applied routinely to multiple layer situations. Some of the work reviewed in this report has paralleled efforts at M.I.T., but it is felt that the independent approaches to the complicated mathematics and programming has been warranted.

2) Surface Electrical Properties Simulation Model

by W.M. Waller of Lockheed Electronics

As a test of the theoretical work, a scale model experiment was designed and constructed by personnel at Lockheed Electronics. This experiment was used to model layers over a perfectly reflecting bottom, layers over a dielectric bottom, tilted layers, scattering bodies, including spheres and crevasses, and antenna patterns. The data from this experiment have been invaluable in

testing out our theoretical developments and in confirming the nature of our observations.

C. Reprints and Preprints

During the course of this contract, a number of papers describing the experiment and its application to glaciers and the moon have been published or accepted for publication. It is interesting that we appear to have been the first to demonstrate that sounding of temperate glaciers can only be done at frequencies less than 8 mhz because of the severe scattering problems encountered. We have also submitted to M.I.T. a report in the form of a paper which is to be incorporated in any way that seems appropriate in connection with a first paper to describe the results of the lunar experiment.

Papers include:

1. G. Simmons, D.W. Strangway, L. Bannister, R. Baker, D. Cubley, G. LaTorraca and R. Watts, The Surface Electrical Properties Experiment, Proc. of the Lunar Geophysics Conference, 258-270, Lunar Science Institute, Houston, Texas, 1972.
2. A.P. Annan, Radio Interferometry Depth Sounding: Part I - theoretical discussion, Geophysics, 38, 557-580, 1973.
3. J.R. Rossiter, G.A. LaTorraca, A.P. Annan, D.W. Strangway

and G. Simmons, Radio Interferometry Depth Sounding: Part II - Experimental Results, Geophysics, 38, 581-599, 1973.

4. D.W. Strangway, G.Simmons, G. LaTorraca, R. Watts, L. Bannister, R. Baker, J.D. Redman and J.R. Rossiter, Radio-frequency interferometry - a new technique for studying glaciers, Jour. of Glaciology, 13, 123-132, 1974.
5. A.P. Annan, W.M. Waller, D.W. Strangway, J.R. Rossiter, J.D. Redman and R.D. Watts, The electromagnetic response of a low-loss, 2-layer, dielectric earth for horizontal electric dipole excitation, accepted for publication, Geophysics.
6. J.R. Rossiter, D.W. Strangway, A.P. Annan, R.D. Watts and J.D. Redman, Detection of thin layers by radio interferometry, accepted for publication, Geophysics.
7. D.W. Strangway, A.P. Annan, J.D. Redman, J.R. Rossiter and R.D. Watts, Electrical structure at Taurus-Littrow, prelim. paper submitted to MIT.
8. G. Simmons, D.W. Strangway, A.P. Annan, R. Baker, L. Bannister, R. Brown, W. Cooper, D. Cubley, J. de Bettencourt, A.W. England, J. Groener, J. Kong, G. LaTorraca, J. Meyer, V. Nanda, J.D. Redman, J.R. Rossiter, L. Tsang, J. Urner and R. Watts, Surface Electrical Properties Experiment, 15-1 - 15-14, NASA SP-330, 1974.

9. R.D. Watts, Line-source radiation over a layered dielectric: inversion of radio interferometry data to be submitted in revised format to Jour. Geophys. Res.

D. Papers in Preparation and Future Plans

In the immediate future we plan to do the following i) write a comprehensive theoretical paper discussing the multiple-layer solutions now available and ii) using this theory and the electrical properties measured on lunar samples, prepare a paper describing a more sophisticated interpretation of the lunar SEP data. Should it be warranted we will redigitize the analogue tape and produce a final tape with the small amounts of missing data.

Our interest in SEP as a terrestrial tool continues. Rossiter is now launching into his Ph.D. thesis work proper. This will involve a careful attempt at automated interpretation of the Juneau icefields and Athabasca data by spectral means. All the data from those field trips is available at Toronto in digital form and already various stripping techniques have been tried. These same approaches will be applied to the lunar data if it seems appropriate.

We are also deeply involved in a new round of field work which has direct application to permafrost problems. This work is supported by the Department of Energy, Mines and Resources of the Canadian government.

D.W. Strangway
Chairman, Geology Department,
University of Toronto

A 1

SURFACE ELECTRICAL PROPERTIES EXPERIMENT
MARK II DATA ACQUISITION SYSTEM

Job Order 62-209

Prepared By

Lockheed Electronics Company, Inc.
Aerospace Systems Division
Houston, Texas

Contract NAS 9-12200

for

PLANETARY AND EARTH SCIENCES DIVISION

National Aeronautics and Space Administration
LYNDON B. JOHNSON SPACE CENTER
Houston, Texas
February 1974

LEC-1914

JSC Form 2028A (Rev Apr 73)
NASA-JSC

SURFACE ELECTRICAL PROPERTIES EXPERIMENT
MARK II DATA ACQUISITION SYSTEM

Job Order 62-209

PREPARED BY

G. L. Wagner, Engineer

APPROVED BY

F. L. Gibbons, Supervisor
Analytical Instrumentation Systems Section

W. R. Walker, Manager
Planetary and Earth Sciences Department

Prepared By

Lockheed Electronics Company, Inc.

For

Planetary and Earth Sciences Division

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION
LYNDON B. JOHNSON SPACE CENTER
HOUSTON, TEXAS

February 1974

LEC-1914

CONTENTS

Section		Page
1.0	GENERAL DESCRIPTION.	1-1
	1.1 PURPOSE	1-1
	1.2 SEP LUNAR EQUIPMENT	1-1
	1.3 LUNAR EQUIPMENT DESCRIPTION	1-3
	1.4 DATA REDUCTION PROCEDURE.	1-10
	1.5 NAVIGATION DATA FORMAT.	1-10
2.0	INSTALLATION AND EXTERNAL SIGNAL APPLICATION.	2-1
	2.1 SYSTEM INTERCONNECTION.	2-1
	2.2 PRELIMINARY TESTING	2-2
	2.3 INPUT AND OUTPUT SIGNAL REQUIREMENTS.	2-3
	2.4 DAS PACKAGING	2-3
3.0	OPERATING INSTRUCTIONS	3-1
	3.1 FRONT PANEL CONTROLS.	3-1
	3.2 INITIAL TURN-ON	3-6
	3.2.1 The Word Start Board	3-7
	3.2.2 The Data Available Signal. . .	3-7
	3.2.3 Input Conditioner.	3-10
	3.2.4 FSK Board.	3-10
	3.2.5 NAV Board.	3-13
	3.2.6 System Clock Board	3-13
	3.2.7 Wang Control	3-17

Section			Page
4.0	THEORY OF OPERATION.		4-1
	4.1 GENERAL		4-1
	4.2 SCIENTIFIC.		4-1
		4.2.1 Input Conditioners	4-1
		4.2.2 Control Timing	4-1
		4.2.3 Data Calculation	4-4
		4.2.4 Data Multiplexing.	4-4
		4.2.5 Data Memory.	4-5
		4.2.6 Wang 700 Control	4-6
	4.3 NAVIGATION.		4-8
		4.3.1 Data Reconstruction.	4-8
		4.3.2 Synchronization.	4-8
		4.3.3 NAV Memory	4-9
		4.3.4 Navigation Accumulators.	4-10
	4.4 DIGITAL TAPE OUTPUT		4-11
	4.5 DETAILED CIRCUIT DESCRIPTION.		4-15
		4.5.1 Input Conditioner, Location 2-B, Drawing #SKD-LSX-0073.	4-15
		4.5.2 Sync. Det., Location 2-T, Drawing #SKD-LSX-0091.	4-16
		4.5.3 Word Start Location 2-T, Drawing #SKD-LSX-0060.	4-17
		4.5.4 Frame Decode, Location 3-T, Drawing #SKD-LSX-0092.	4-18
		4.5.5 VCO Gate, Location 4-T, Drawing #SKD-LSX-0093.	4-19

Section Page

4.5.6 Data Available, Location 5-T, Drawing #SKD-LSX-0094 4-20

4.5.7 Clock Counter, Location 6-T, 7-T, 8-T, 9-T, Drawing #SKD-LSX-0095 4-21

4.5.8 Data Strobe, Location 11-T, Drawing #SKD-LSX-0097 4-22

4.5.9 Data I/O, Location 12-T, 13-T, 14-T, 16-T, 17-T, 18-T, 20-T, 21-T, 22-T, 24-T, 25-T, 26-T, Drawing #SKD-LSX-0068 4-23

4.5.10 Data Buff, Location 15-T, 19-T, 23-T, 24-T, Drawing #SKD-LSX-0069 4-24

4.5.11 Mode Detect, Location 10-T, Drawing #SKD-LSX-0096 4-24

4.5.12 Frame Counter, Location 28-T, Drawing #SKD-LSX-0098 4-26

4.5.13 Driver Inverter, Location 29-T, Drawing #SKD-LSX-0099 4-27

4.5.14 Crystal Clock, Location 1B, Drawing #SKD-LSX-0101 4-27

4.5.15 FSK Board, Location 3-B, Drawing #SKD-LSX-0102 4-28

4.5.16 NAV Board, Location 4-B, Drawing #SKD-LSX-0103 4-31

4.5.17 Systems Clock, Location 5-B, Drawing #SKD-LSX-0104 4-33

4.5.18 Memory In Control, Location 6-B, Drawing #SKD-LSX-0105 4-36

4.5.19 Two x Twelve Multiplexer Location 7, 8, 19, 20B, Drawing #SKD-LSX-0107 4-39

Section Page

4.5.20 8 × 195 Memory, Location 9, 10, 11, 12, 13, 14, and 18-B, Drawing #SKD-LSX-0108 4-40

4.5.21 Wang Control, Location 15B and 16B, Drawing #SKD-LSX-0072 and #SKD-LSX-0071 4-42

4.5.22 Mag Tape, Location 17B, Drawing #SKD-LSX-0077 4-49

4.5.23 Memory Out Control, Location 21B, Drawing #SKD-LSX-0109 4-51

4.5.24 TCD Control, Location 22B, Drawing #SKD-LSX-0111 4-56

4.5.25 Up-Down Counter, Location 23B, 24B, 25B, 27B, 28B, and 30B, Drawing #SKD-LSX-0112 4-58

4.5.26 LED Driver/Buffer, Location 30T, 31T, 32T, 26B, and 29B, Drawing #SKD-LSX-0075 4-59

4.5.27 Six Decode Numeric Display, Drawing #SKD-LSX-0100 4-61

APPENDIX

A MAINTENANCE — SCHEMATIC DIAGRAMS A-1

B WIRE LIST. B-1

C COMPONENT SPECIFICATIONS C-1

TABLES

Table		Page
I	OPERATORS CONTROL SWITCHES	3-1
II	TIME AND DEFINITION OF INPUTS.	4-7
III	TAPE FORMAT AND SEQUENTIAL STEPS	4-12

FIGURES

Figure		Page
1	The SEP transmitter.	1-2
2	The SEP receiver	1-4
3	The DSEA tape recorder	1-5
4	Artist's drawing of the SEP transmitter, receiver, and the LRV on the surface of the moon	1-6
5	SEP transmitter and LRV receiver in deployed configuration.	1-7
6	Diagram of the six SEP frequencies	1-8
7	Diagram of the data stripping procedure. . . .	1-11
8	Second step in SEP data reduction.	1-12
9	Navigation data format	1-14
10	Location of grounding straps	3-8
11	Location of resistor R4.	3-9
12	Location of gain setting resistors	3-11
13	FSK board.	3-12
14	NAV board.	3-14
15	System clock board	3-15
16	Wang control	3-16
17	VCO data stream.	4-3

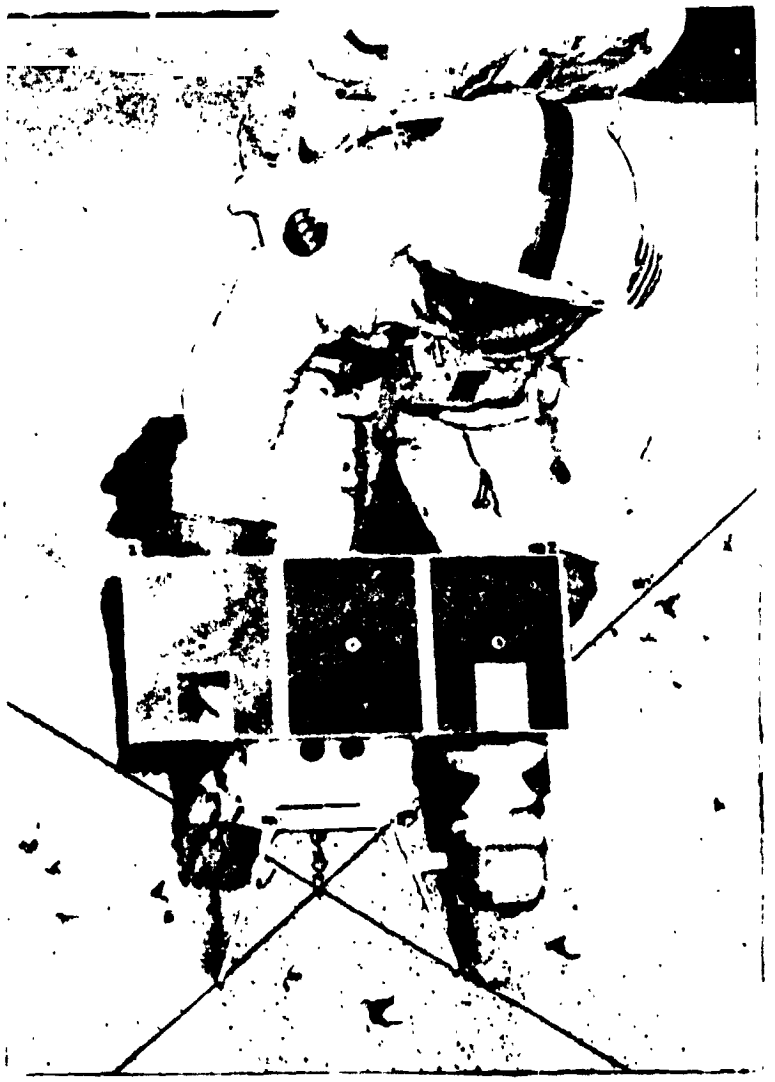
1.0 GENERAL DESCRIPTION

1.1 PURPOSE

The Mark II Surface Electrical Properties Experiment Data Acquisition System (SEP DAS) reduces data to support the SEP experiment flown on Apollo 17. The DAS is presented analog data tapes containing all experimental information. The DAS then digitizes the information, outputs a digital computer compatible magnetic tape, and in parallel, sends data to a Wang 700 calculator for a "quick look" analysis of the data. Information put into the DAS consists of two types, scientific and navigational. The navigational information is decoded and presented to the digital tape intact, while the distance traveled, range and bearing to the LEM, is accumulated and the accumulated value sent to the Wang 700.

1.2 SEP LUNAR EQUIPMENT

A small low power transmitter, as shown in figure 1, is set out by the astronauts on the moon, and two crossed dipole antennas are also laid on the surface of the moon. The SEP dipoles are 70 meters tip-to-tip.



Astronaut Cernan, who will set up this part of SEP on the Moon, practiced many times on Earth. Shown here is the compact SEP transmitter with its solar panel power source and dipole antennas deployed. The transmitter electronics package is covered on the bottom five sides with a thermal blanket. Because the top of the unit is shaded by the solar panel, the uncovered surface needs only a coat of thermal paint to provide adequate cooling for the enclosed electronics. The balance between heat lost to cold space by radiation and that generated inside the unit by the electronics equipment is very delicate and requires careful thermal design.

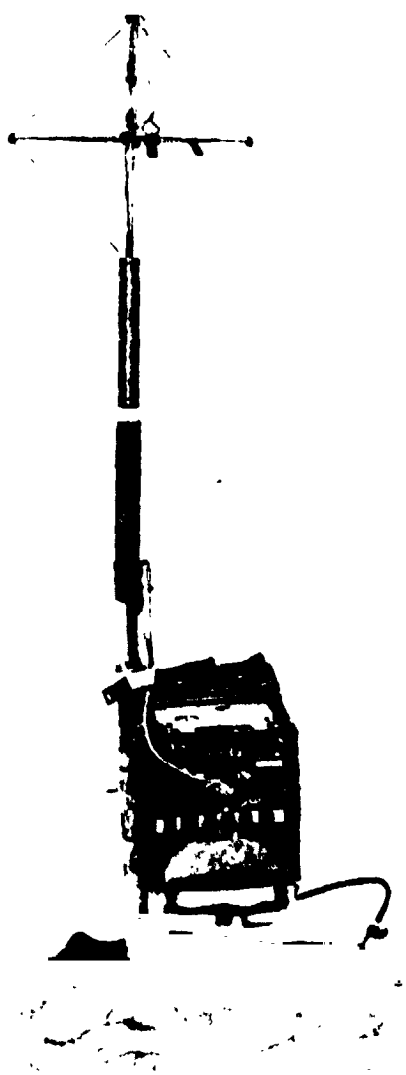
Figure 1. – The SEP transmitter.

The receiver and receiving antennas shown in figure 2 are also unpacked from the pallet on which they are carried to the moon. The astronauts mount both antennas on the Lunar Roving Vehicle (LRV). Inside the receiver there is a cassette magnetic tape recorder, designated the Data Storage Electronics Assembly (DSEA), which is returned to Earth so that the data can be analyzed. The DSEA is shown in figure 3. In addition to the SEP data, information on the location and speed of the Rover, obtained from the Rover's navigation system, is also recorded on the tape.

Figures 4 and 5 illustrate the equipment set out on the moon and show it ready for operation.

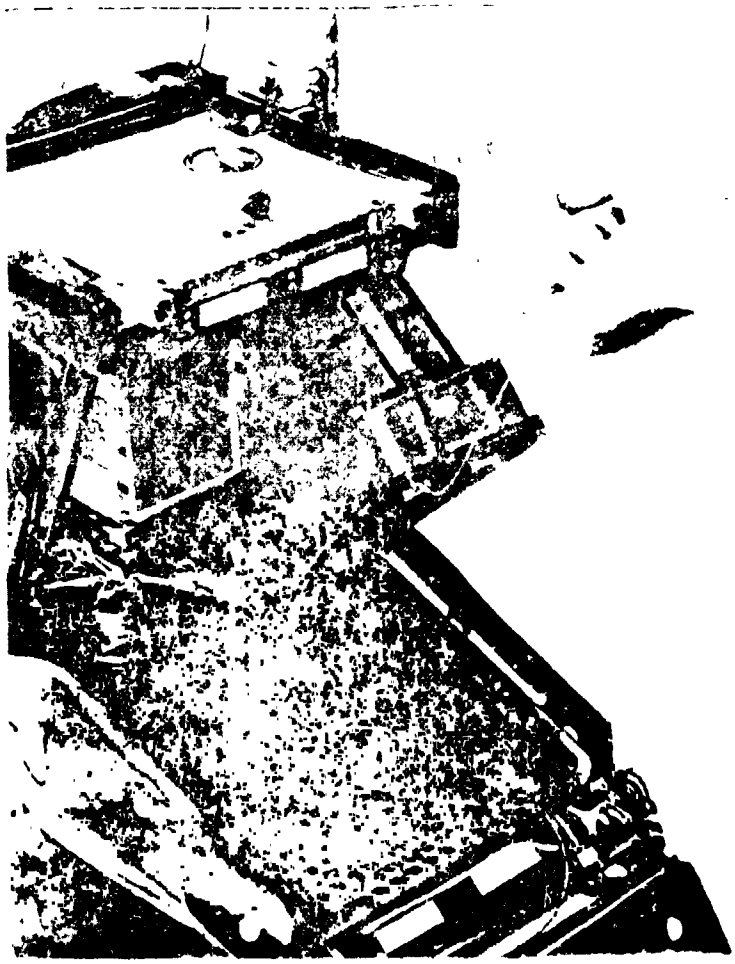
1.3 LUNAR EQUIPMENT DESCRIPTION

The six SEP frequencies are transmitted and received according to the scheme shown in figure 6. One frame, which is 38.6 seconds in duration, consists of six 6.4 second subframes that are identical except for the receiver calibration and synchronization process. In subframe 1, for example, the receiver is calibrated at 32.1 MHz and 16 MHz; the synchronization signal is transmitted on the NS dipole and received on the X antenna. In subframe 2, the receiver is calibrated at



The SEP receiver electronics including tape recorder and battery are contained in a nine inch box which is completely enclosed in a thermal blanket. Optical solar reflectors, which act as one-way mirrors to release internally generated heat into space and simultaneously reflect sunlight are shown here with the thermal blanket opened. The three-loop antenna folded during the journey to the Moon, is shown unfolded as it will be used on the Moon. The astronaut at the end of the experiment removed the tape recorder from the box and brings it back to Earth.

Figure 2. – The SEP receiver.



This photograph illustrates how the astronaut will remove the DSEA tape recorder from the receiver at the end of the last EVA for return to Earth.

Figure 3. — The DSEA tape recorder.

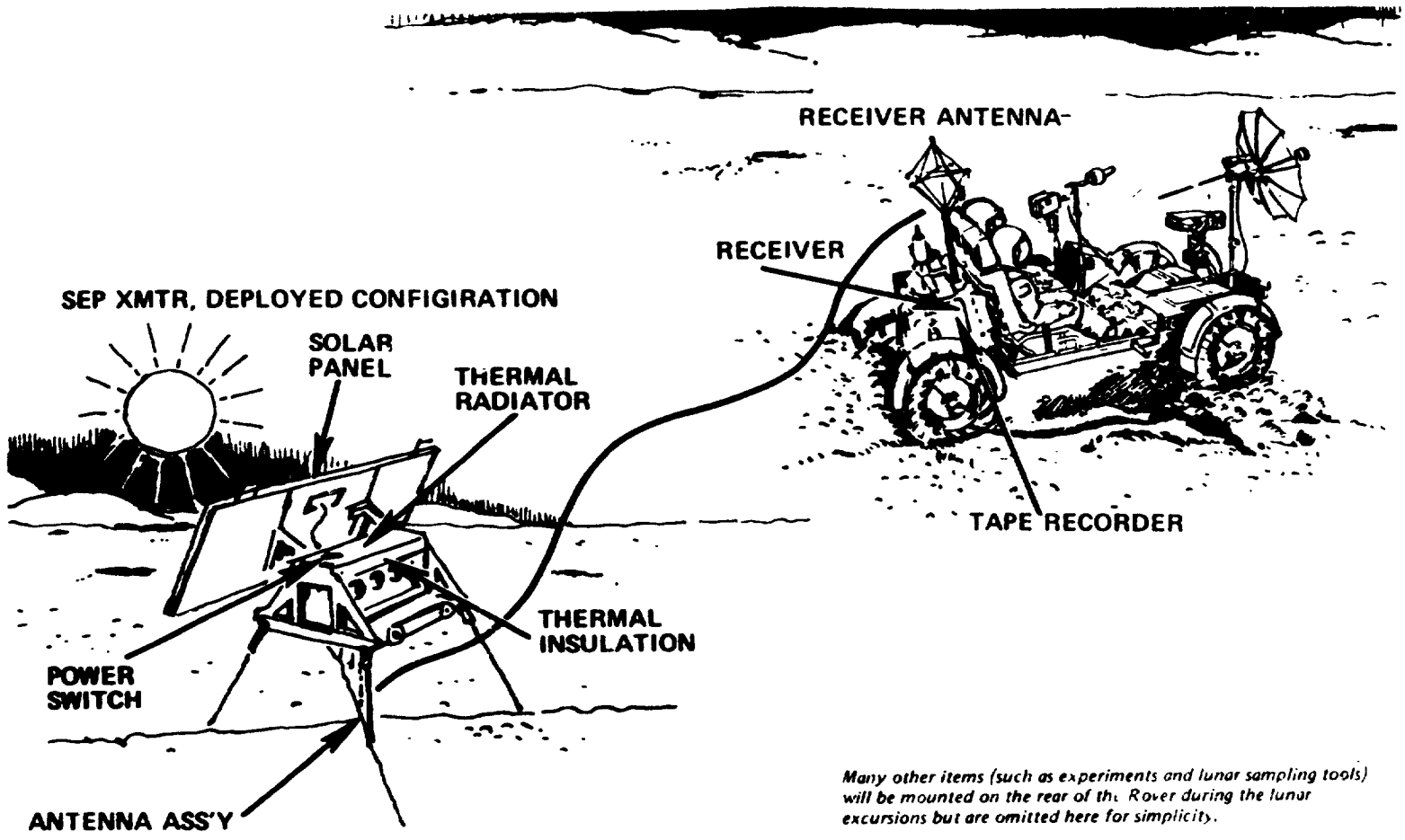
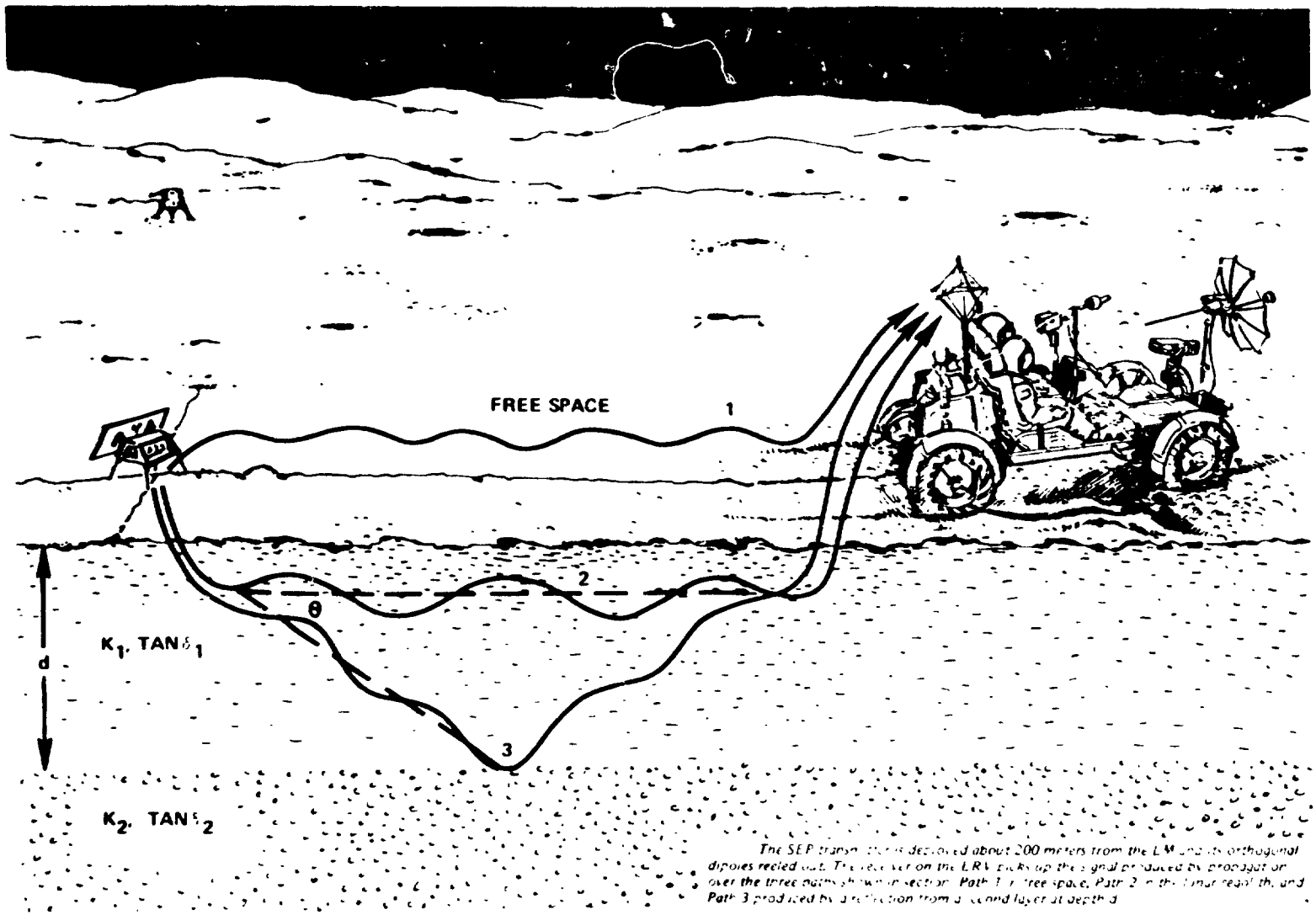


Figure 4. – Artist's drawing of the SEP transmitter, receiver, and the LRV on the surface of the moon.



The SEP transmitter is deployed about 200 meters from the LM and its orthogonal dipoles reeled out. The receiver on the LRV picks up the signal produced by propagation over the three paths shown in section: Path 1 in free space, Path 2 in the lunar regolith, and Path 3 produced by reflection from a second layer at depth d.

Figure 5. — SEP transmitter and LRV receiver in deployed configuration.

REPRODUCIBILITY OF THE ORIGINAL PAGE IS POOR

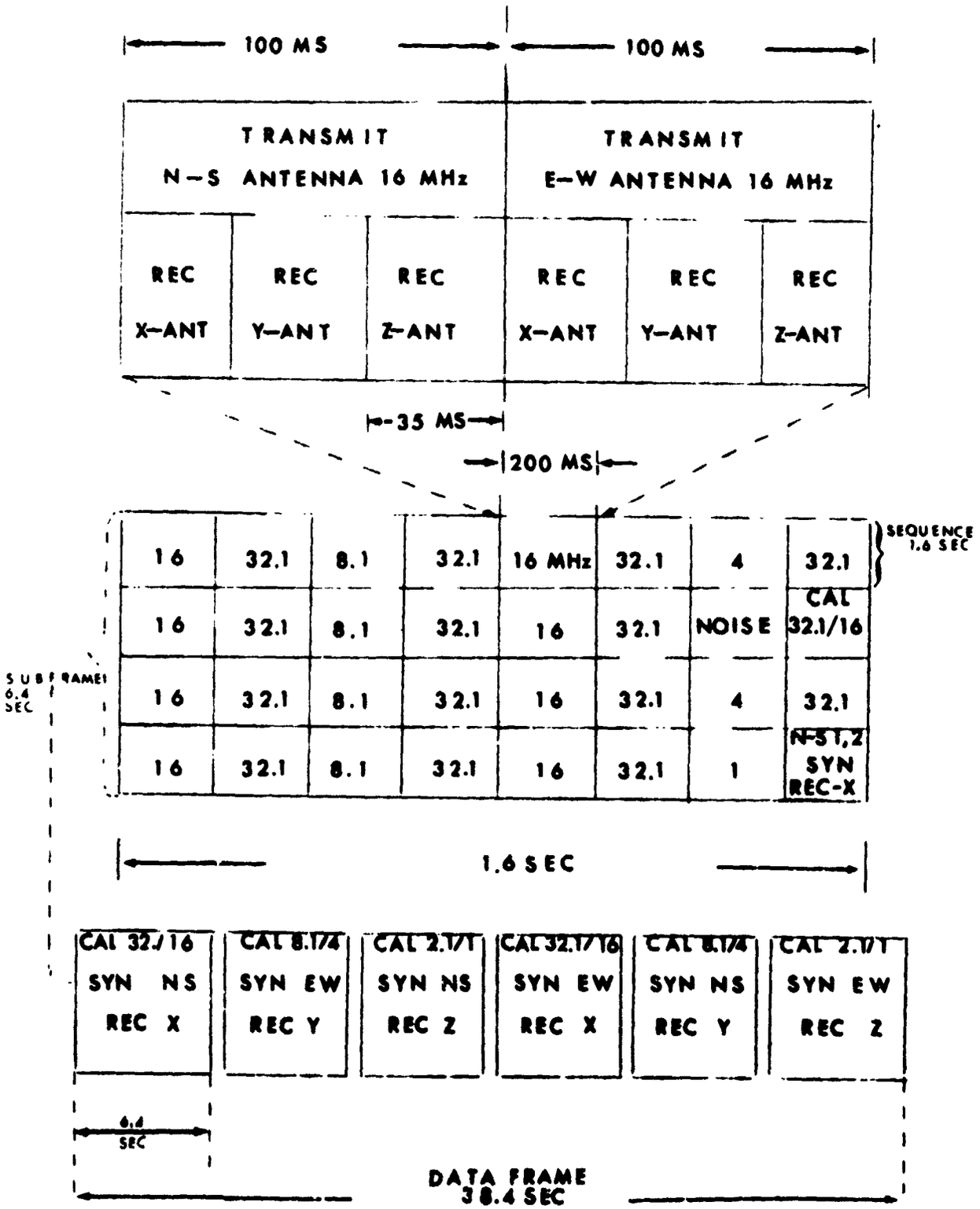


Figure 6. – Diagram of the six SEP frequencies.

8.1 MHz and 4 MHz, and the synchronization signal is transmitted on the EW antenna and received on the Y antenna. Each experiment frequency sequence is repeated exactly as shown in all six subframes. Each individual experiment frequency is transmitted first on the NS antenna for 100 milliseconds and then on the EW antenna for 100 milliseconds. During each 100 millisecond transmission interval, the receiver "looks" at the transmitted signal for a period of 33 milliseconds with each of the three orthogonal (X, Y, and Z) receiving loops. In addition to the above, once during each subframe the receiver observes environmental noise and records its amplitude.

The receiver acquires the transmitter signal sequence automatically as long as the signal exceeds a given threshold. Synchronization of the receiver is accomplished when both (or either) the 1 and 2.1 MHz signals exceed a given threshold. The loop antennas are connected sequentially to a low noise amplifier section which amplifies, converts (in frequency), and logarithmically compresses the amplitude of the received signal. A constant amplitude, variable frequency signal (in the band of 300 to 3000 Hz) corresponding to the logarithm of the received signal amplitude, is recorded on magnetic tape in the DSEA. The DSEA can record nearly 10 hours of data.

Upon completion of the experiment, the astronaut removes the DSEA from the receiver, as indicated in figure 3, for return to earth.

1.4 DATA REDUCTION PROCEDURE

Upon return to Earth the DSEA data tapes are demultiplexed, and the demultiplexed data are recorded on a LEC model 417 analog recorder. Refer to figure 7 for data stripping procedure. The three bands of frequencies containing the reference clock, voltage controlled oscillator (VCO) data, and navigation data are filtered from the composite signal and recorded on individual tracks on the LEC recorder. Extreme care must be taken when analyzing data from the DSEA recorder due to the very poor fidelity and tape speed fluctuations of the recorder.

Figure 8 shows the second step in reducing the SEP data. The primary output of the DAS is the computer digital tape, for it is at this level that the detailed data analysis is performed. The Wang 700 is capable of only "looking" at a few words per frame and performing the mathematical calculations needed to analyze the data.

1.5 NAVIGATION DATA FORMAT

The navigational data, as mentioned above, is recorded on the DSEA recorder. Input data is received from the Rover's

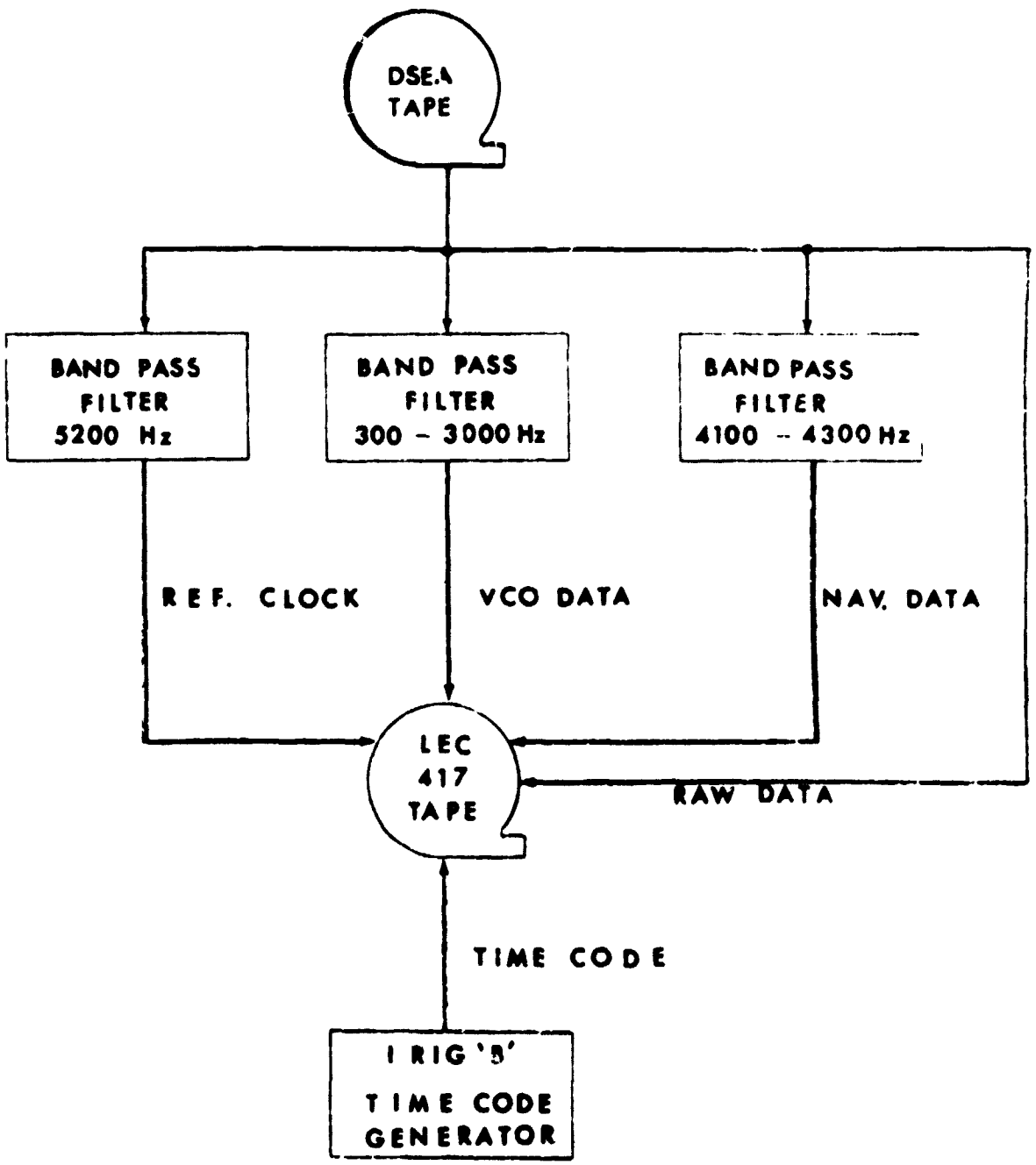


Figure 7. — Diagram of the data stripping procedure.

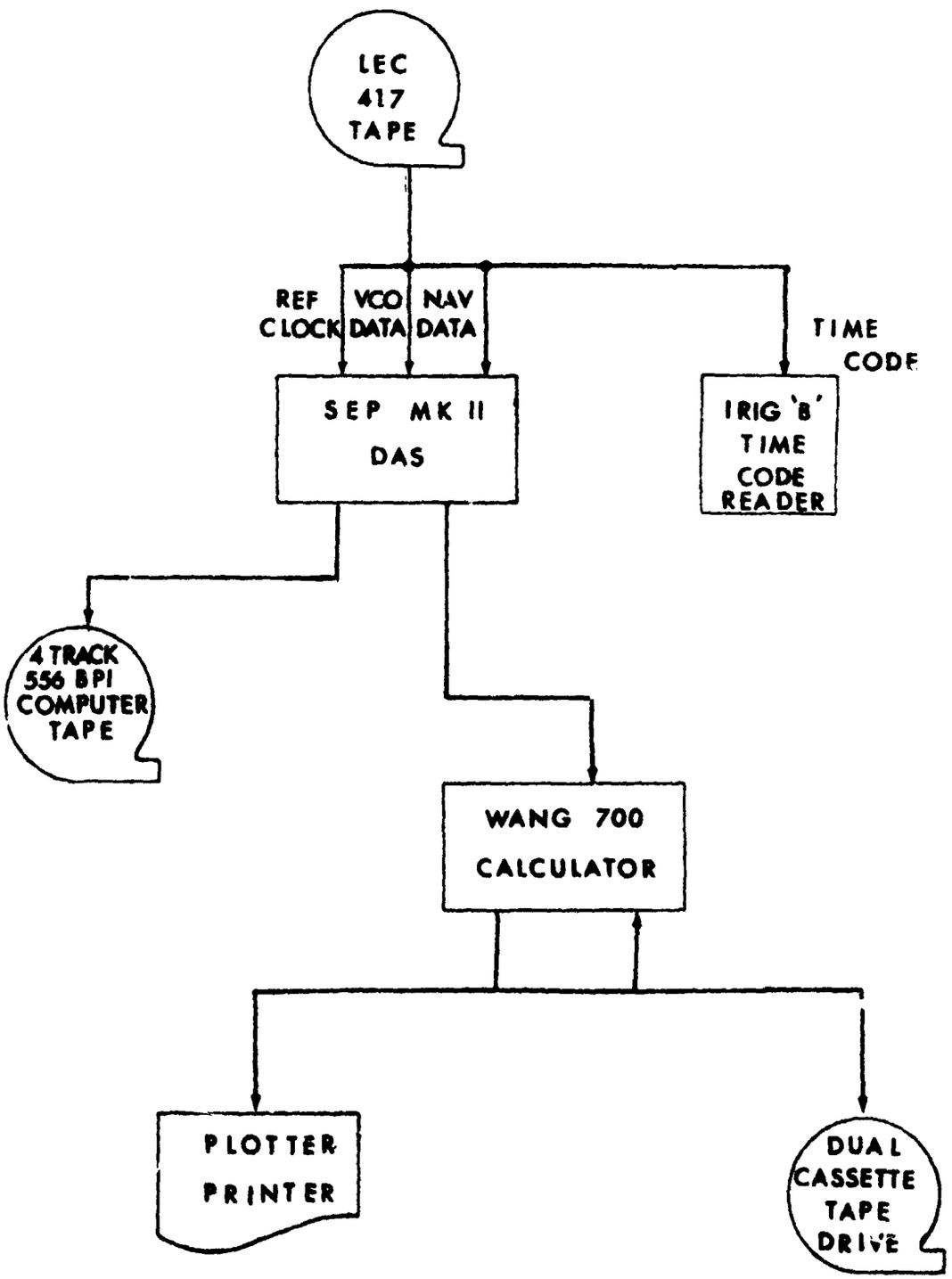


Figure 8. — Second step in SEP data reduction.

on-board navigational computer with the format of six parallel binary bits every 78.75 milliseconds. The six bits of information are listed below:

Bit 1 - Range plus - increase range .1 km

Bit 2 - Range minus - decrease range .1 km

Bit 3 - Bearing plus - increase bearing 1°

Bit 4 - Bearing minus - decrease bearing 1°

Bit 5 - Odometer front - 4 revolutions left front wheel

Bit 6 - Odometer rear - 4 revolutions right rear wheel

Bit 7 - Synchronization - always present

The seven bits of information are accepted by the system, serialized, and then converted to a frequency shift key (FSK) signal of 4175 Hz and 4625 Hz for recording. Limitations of the system require that no one bit may be present for more than three consecutive data frames, with the exception of the sync bit which must be present in each frame. Refer to figure 9 for data format.

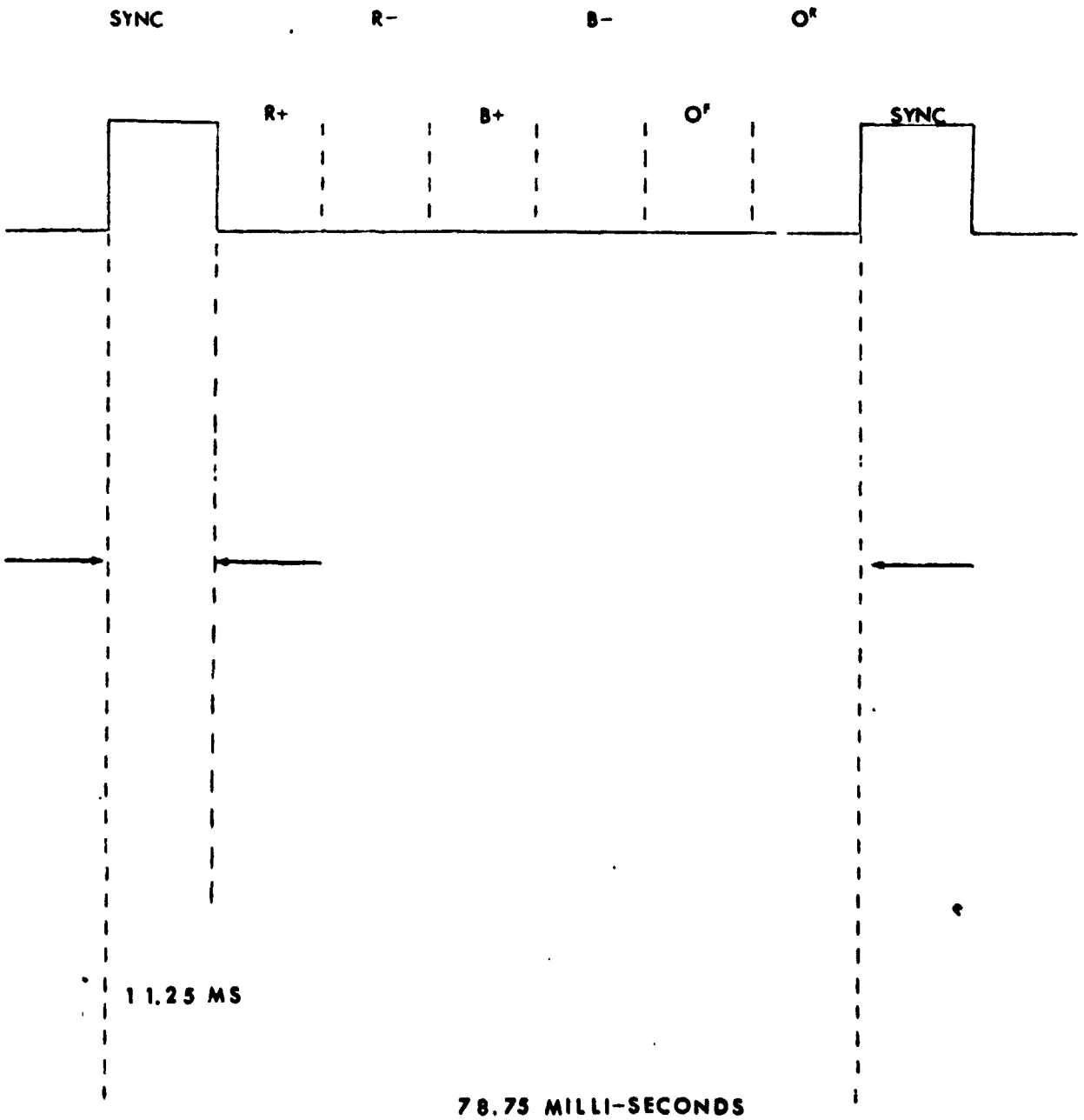


Figure 9. – Navigation data format.

2.0 INSTALLATION AND EXTERNAL SIGNAL APPLICATION

2.1 SYSTEM INTERCONNECTION

Refer to the systems interconnection diagram, drawing #SKD-LMX-0089, in appendix A. The DAS system comprises three separate packages: (1) the DAS system proper, (2) an external fan assembly, and (3) an external 5 volt, 10 amp power supply. These three units are rack mounted units, to be mounted in a standard 19-inch relay rack. The DAS system must be mounted on top of the fan assembly for correct ventilation. A Sorensen 5-volt, 10-amp power supply is provided to supply power to the DAS system. Power consumption of the system is approximately 50 watts. Interconnection between the power supply and the DAS is made via terminal block J3 as shown on rear panel drawing SKD-APX-0088. Data input to the DAS is made available from a LEC model 417 analog tape recorder. Data inputs are via RG cable to BNC connectors on the rear panel of the DAS, as VCO, TCD, and 5.2 kHz inputs. Outputs from the DAS are to a Cipher 100H digital tape recorder and to a Wang 700 calculator via connectors J2 and J1, respectively, on the rear panel of the DAS. Refer to the respective tech manuals for the LEC 417 analog recorder, the Cipher 100H digital tape recorder, and the Wang 700 calculator for power requirements and environmental operating conditions.

2.2 PRELIMINARY TESTING

Before the DAS is turned on for the first time perform the following checks:

1. Ensure that the ambient temperature is not greater than 40° C.
2. Ensure that the fan assembly is mounted below the DAS and is operational.
3. Make sure that the input signal levels conform to those in section 2.3.
4. Apply power to the Sorensen 5-volt supply, and adjust voltage to 5 volts and the over-trip voltage to 5.5.
5. Apply power to the DAS.
6. Place the front panel peripheral control switch to the down position and observe the frame counter advancing from 1 to 32, at a rate of approximately 10 seconds per complete cycle.
7. Connect the DAS to the Cipher 100H digital recorder and to the Wang 700 calculator.
8. The DAS is now ready for operation.

2.3 INPUT AND OUTPUT SIGNAL REQUIREMENTS

1. VCO input – The VCO input is a frequency band of 300 to 3000 Hz. A maximum 1 volt rms signal is desired, however, gain controls within the DAS allow the signal to be .5 to 2 volts in amplitude.
2. TCD input – This is the FSK signal operating at either 4175 Hz or 4625 Hz at a 1 V rms level.
3. 5.2 kHz input – This is a frequency reference source and determines the stability of the data reduction of the DAS. Input levels should be 1 V rms.
4. Wang 700 output – Refer to the Wang 700 calculator tech manual for logic level definitions.
5. Cipher digital tape recorder output – Refer to the digital tape recorder tech manual for definition of all input/output signals.

2.4 DAS PACKAGING

The DAS is packaged in two printed circuit (pc) card guides with each pc card guide containing a maximum of 32 pc cards. The dimension of each pc card is approximately 4.5 × 6.5 inches. The pc cards are connected to a card connector that is wired to the front and rear panels for operator indication and for input/output. The numbering system of the pc card used throughout the document refers to location by

pc card slot location and to the top rack and the bottom rack. For example pc card 1B would be pc card slot 1 located in the bottom. Integrated circuit numbers are designated with a prefix of U throughout all the discussions with a component location shown on the schematic diagram of each pc board type.

3.0 OPERATING INSTRUCTIONS

3.1 FRONT PANEL CONTROLS

Drawings number SKD-APX-0086 and SKD-APX-0087 give a pictorial representation of the location of the operator control switches for the top and bottom rack respectively. Table I lists the name and describes the function of all operator controls.

TABLE I. – OPERATORS CONTROL SWITCHES

Name	Function
Mode Indication	The Mode Indication consists of 4 indicator lamps on the top rack. Only one of the four lights will be turned on at any one time, indicating the mode of the receiver.
Receiver Lock	This light, when on, indicates that the receiver has established synchronization with the transmitter and that the data received is good.

Peripheral Control	This is a three position switch. In the top position, the DAS is placed in a normal operating mode; in the center position, data output to the Cipher 100H digital tape recorder and to the Wang 700 calculator is inhibited. In the down position, a dummy start signal is provided internally to the DAS and may be used to check the basic timing and gating for the DAS system.
Memory Clear	This is a push button switch that when depressed will zero the Data memory.
Lamp Test	This is a push button switch that when depressed will cause all light emitting diode (LED) numeric displays to display the number 8, allowing the operator to check the operation of all segments of the displays.

Prime	This control consists of an indicator lamp and a push button. When the button is depressed, the system may be manually forced into the prime mode with the prime light on. The prime light will be turned on automatically at any time when the system automatically primes itself.
Program Error	The program error is a push button switch and an indicator light. If at any time the Wang 700 does not receive a complete transmission of all data from the DAS system, the program error will be turned on and may only be extinguished manually by depressing the program error push button.
Frame Display	This is a two decade LED numeric display, displaying the current frame of the data.

Frame Select	This is two decades of thumbwheel selection digit switches. This allows the operator to select the frame to be displayed on the front panel LED display.
Run Number	This is a two decade thumbwheel switch setting allowing the operator to select an identification number to be written on the digital tape for each run that he wishes to make.
VCO Count	This is a one decade thumbwheel switch setting that determines the number of VCO cycles that will be contained within a one-gate period.
Gate Delay	This is a two-decade switch setting that would delay the gate period from the start of the word time by the number set into the digit switches.

Scale Time	This is a two-position selector switch that will select either one or 10 microseconds as the resolution of the digitizatior of the gate period.
Subframe select	This selects either subframe 1 or subframe 2 to be displayed on the front panel numeric displays.
Word Select	This is a three-position selector switch that will select words 1, 2, or 3 to be displayed on the front panel numeric displays.
Range Preset	This is a three-position decade switch allowing the operator to preset any range into the DAS system.
Range Load	This will load the preset number into the range accumulator.
Cdometer Preset	This allows the operator to set in any 6-decade number into the odometer accumulator.

Odometer Load	This allows the operator to load the preset number into the odometer accumulator.
Wheel Select	This is a two-position switch allowing the operator to select either the front wheel or the rear wheel to the odometer count accumulator.
Bearing Preset	This is a three decade switch that allows the operator to preset any bearing into the bearing accumulator.
Bearing Load	This is a push button switch that allows the operator to set the preset bearing information into the bearing accumulator.

3.2 INITIAL TURN-ON

In addition to the front panel operator controls, there exists on several pc cards variable functions that must be defined prior to system operation. These functions are defined by hardware jumpering of the individual pc cards or by switches located on the pc card itself. This function

once defined will remain fixed throughout all of the data taking procedures.

3.2.1 The Word Start Board

The word start board, location 2B, contains a 3-decade down counter that must be programmed to full count. Refer to figure 10 for location of the grounding straps. Each decade preset is performed by bussing the input 1, 2, 4, or 8 bit to a zero or a one logical level. The correct setting for this board is a count of 351. This is accomplished by placing the appropriate jumpers between a 1, 2, 4, or 8 input to the counter to the appropriate zero or logical one input. For the 300 digit or 10^2 digit, the 1 input is bussed to logical one or the 5 volt level, the 2 input to the 5 volt level, the 4 and 8 inputs to a ground level or logical zero. For the 10^1, the 1 and 4 are bussed to a logical one level and the 2 and 8 to a logical zero; for the 10^0, the 1 to a logical one level and the 2, 4, and 8 to a logical zero, thus giving us 351.

3.2.2 The Data Available Signal

The data available signal is controlled by a delay circuit made up of a delay one shot and a pulse shaping one shot. The delay one shot is set manually by resistor R4, as shown in figure 11, to a pulse width of 32 milliseconds.

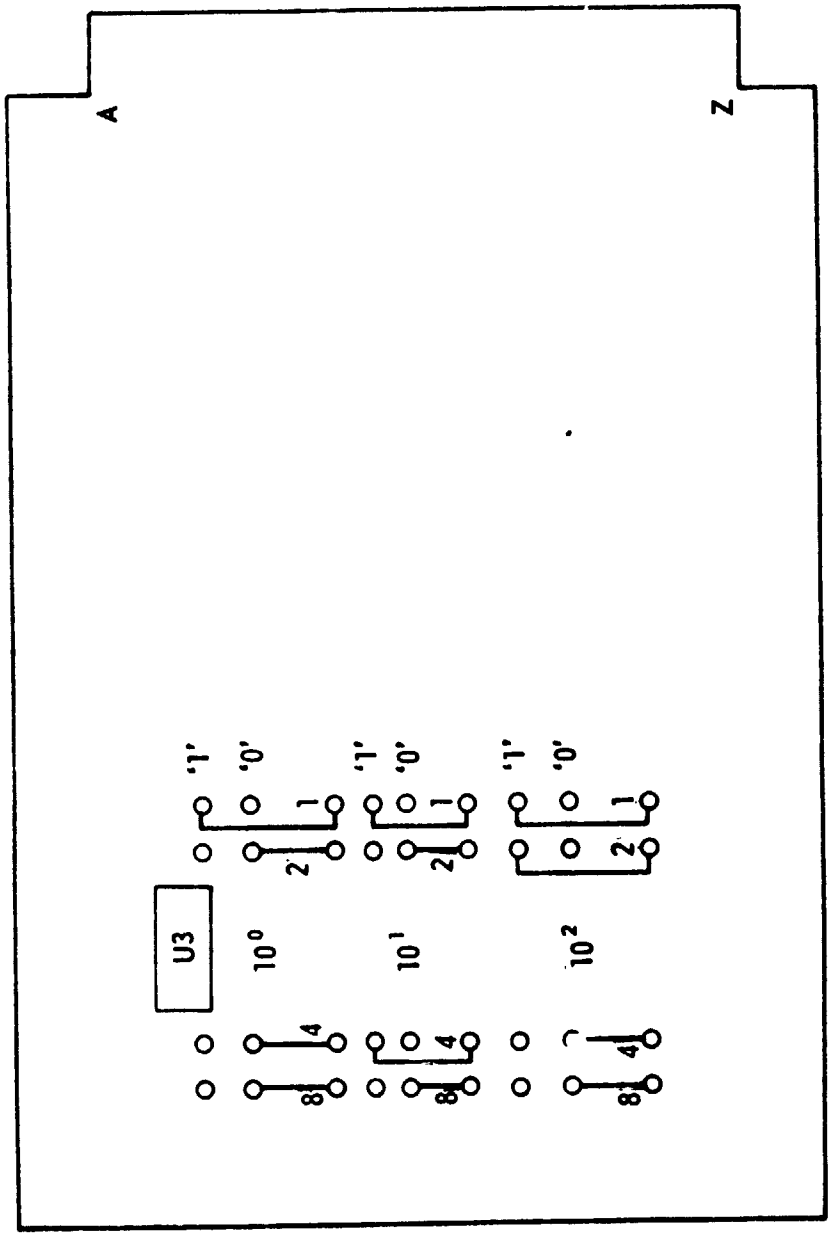


Figure 10. – Location of grounding straps.

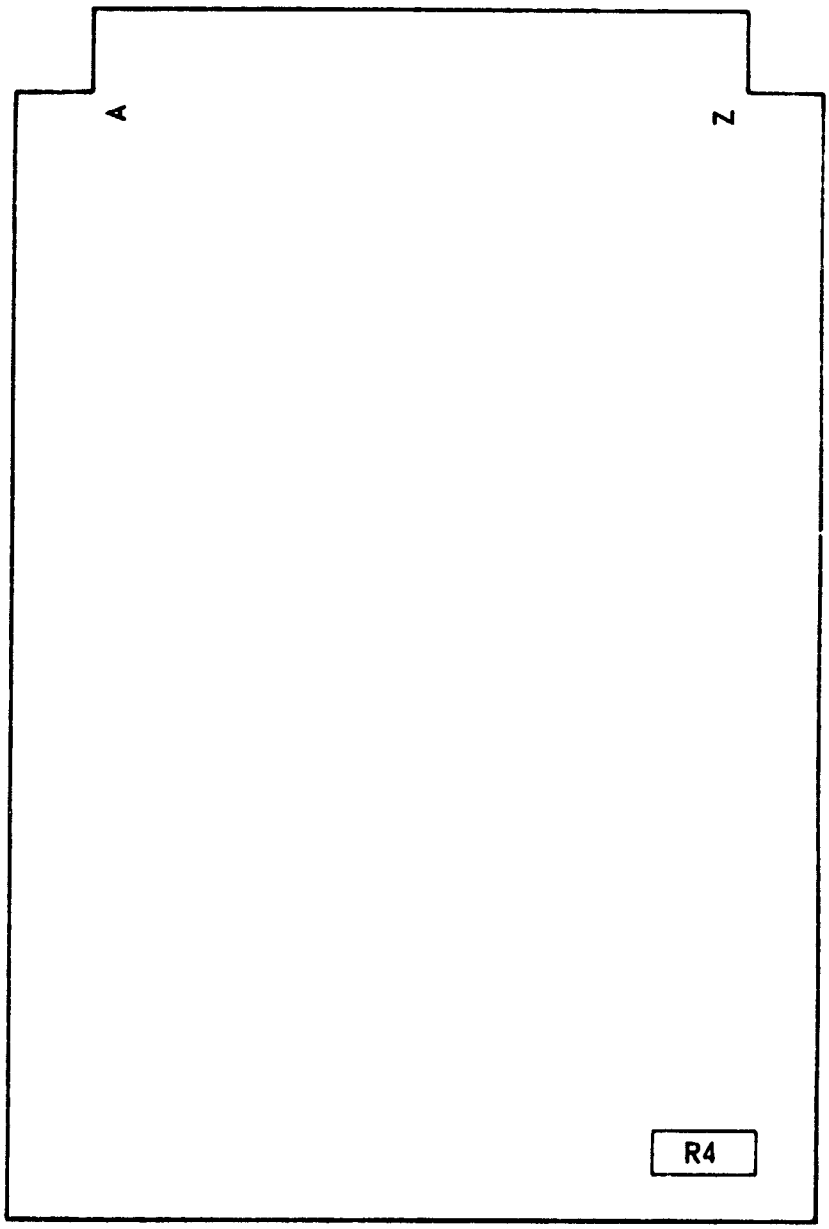


Figure 11. — Location of resistor R4.

3.2.3 Input Conditioner

The gain of the input signals, 5.2 kHz, VCO input, and TCD input, must be manually set to conform to the input signal levels from the LEC model 417 recorder. Figure 12 shows the location of the gain setting resistors for the input conditioning circuits. Monitor TP1 on board 2B adjusting R2 for a 0 to 5 volt square wave output of 5.2 kHz, and monitor TP2 while adjusting R8 for a 0 to 5 volt signal of the VCO input. Monitor TP3 while adjusting R11 for 1 volt rms output from the input conditioner of the TCD input signal.

3.2.4 FSK Board

Refer to figure 13 with a known FSK (TCD) signal, monitor TP2 on board 3B while adjusting R7 for a 0 to 5 volt logical level output for the FSK data. And then monitor TP4 while adjusting R10 for a 0 to 5 volt transistor-transistor logic (TTL) level signal that has no short pulse width transitions of the data. Monitor TP6 while adjusting R11 for an output width of 5 milliseconds. And finally monitor TP5 and adjust R15 for an output pulse width signal of 5 milliseconds. Monitor TP7 for the final FSK data stream.

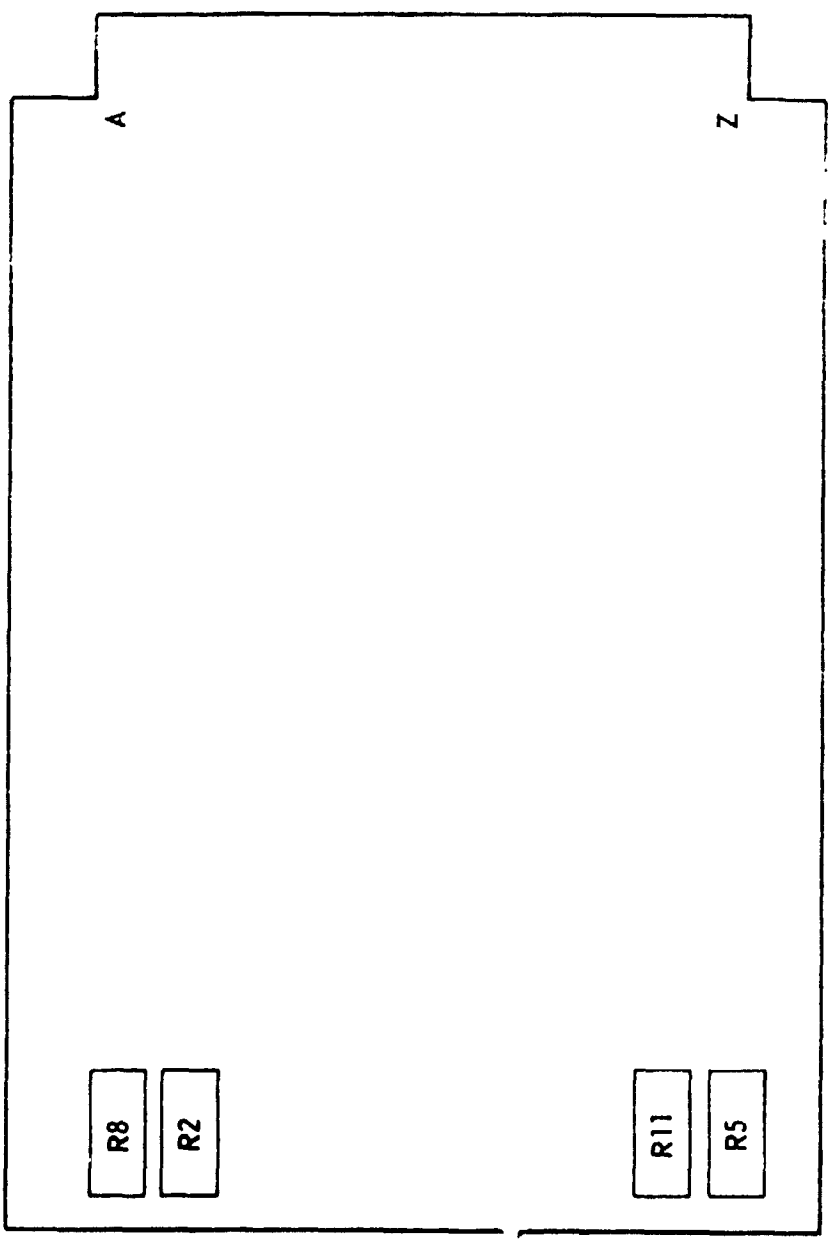


Figure 12. – Location of gain setting resistors.

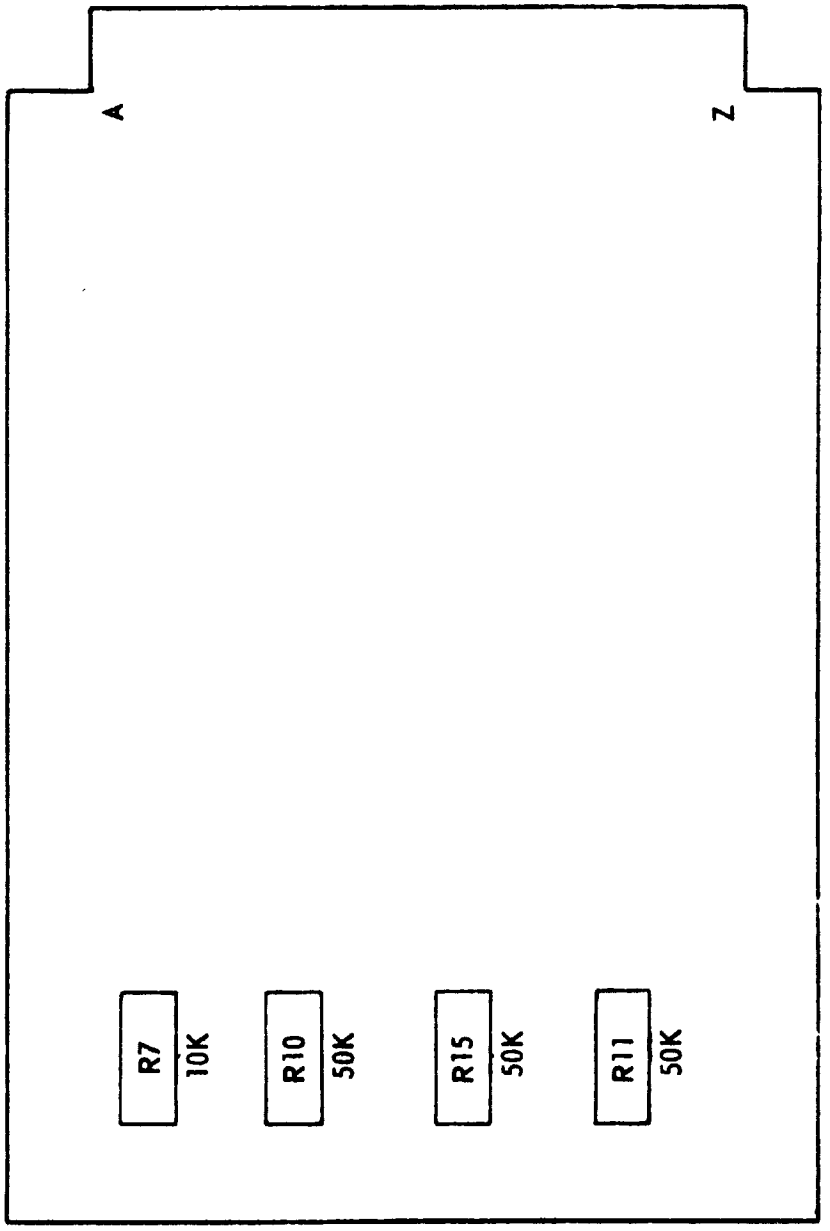


Figure 13. — FSK board.

3.2.5 NAV Board

See figure 14. As described in section 4.3.2, two TCD strobe signals may be selected. This is performed by the selection of switch S1 as shown on figure 14.

3.2.6 System Clock Board

See figure 15. The system clock board, location 5B has two possible inputs. These inputs are selected by hard-wired jumpers connecting either pin 3 or pin C to pin 1 of integrated circuit (IC) U4, pin 3 being a signal of 88 Hz, and pin C being a signal of 5.2 kHz. The pc board contains four sets of switches that gives the multiplication factor of the input signal. The switches are labeled S1, S2, S3, and S4. Switch S4 gives the whole number multiplication factor, and switch S2, S3, and S4 gives the fractional multiplication factor with a limit of 1.000 to 2.999. The output of the board is delivered from a divider chain that is dependent upon the input signal. If pin 3 of the pc card or 88 Hz was selected as the input, the output must be jumpered such that U2 pin 12 is connected to U5 pin 1. If 5.2 kHz was selected as the input, then U1 pin 12 must be connected to U5 pin 1.

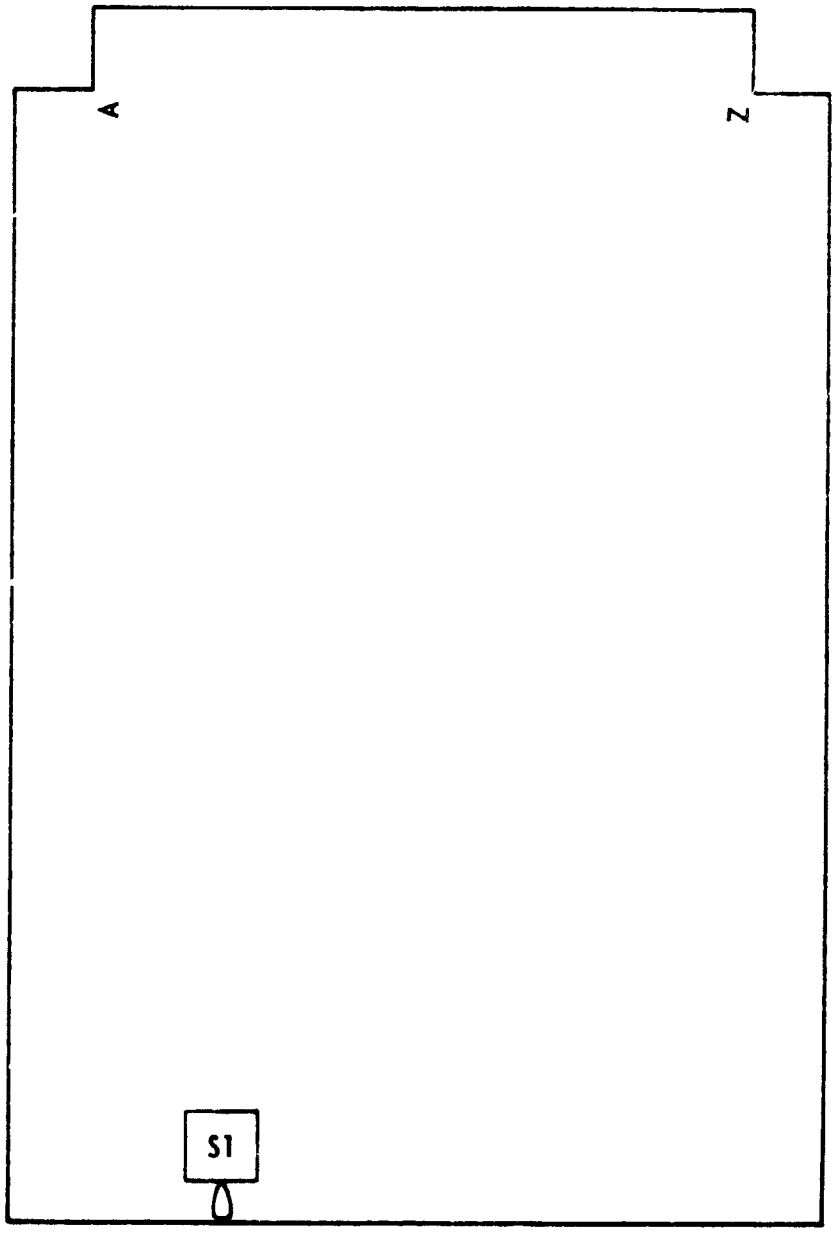


Figure 14. — NAV board.

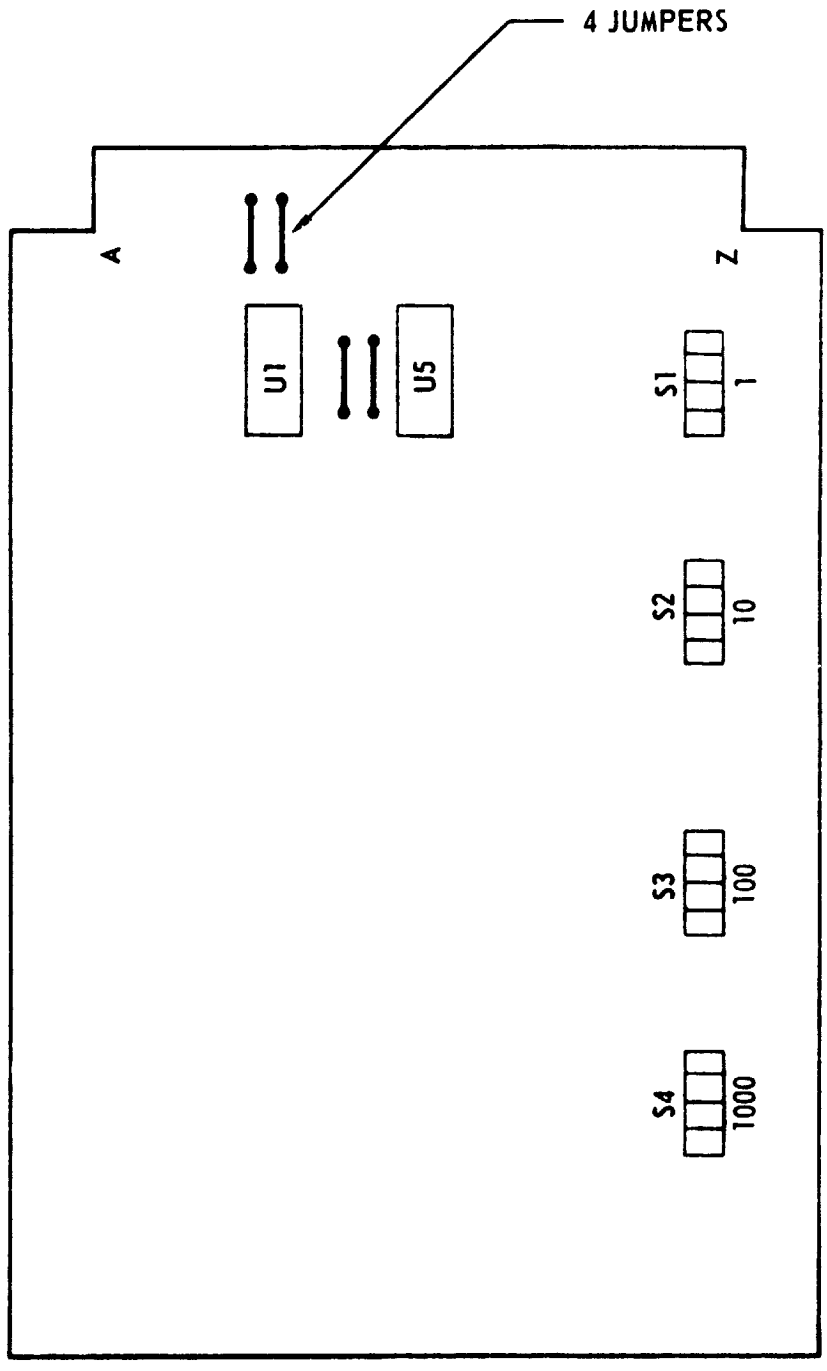


Figure 15. — System clock board.

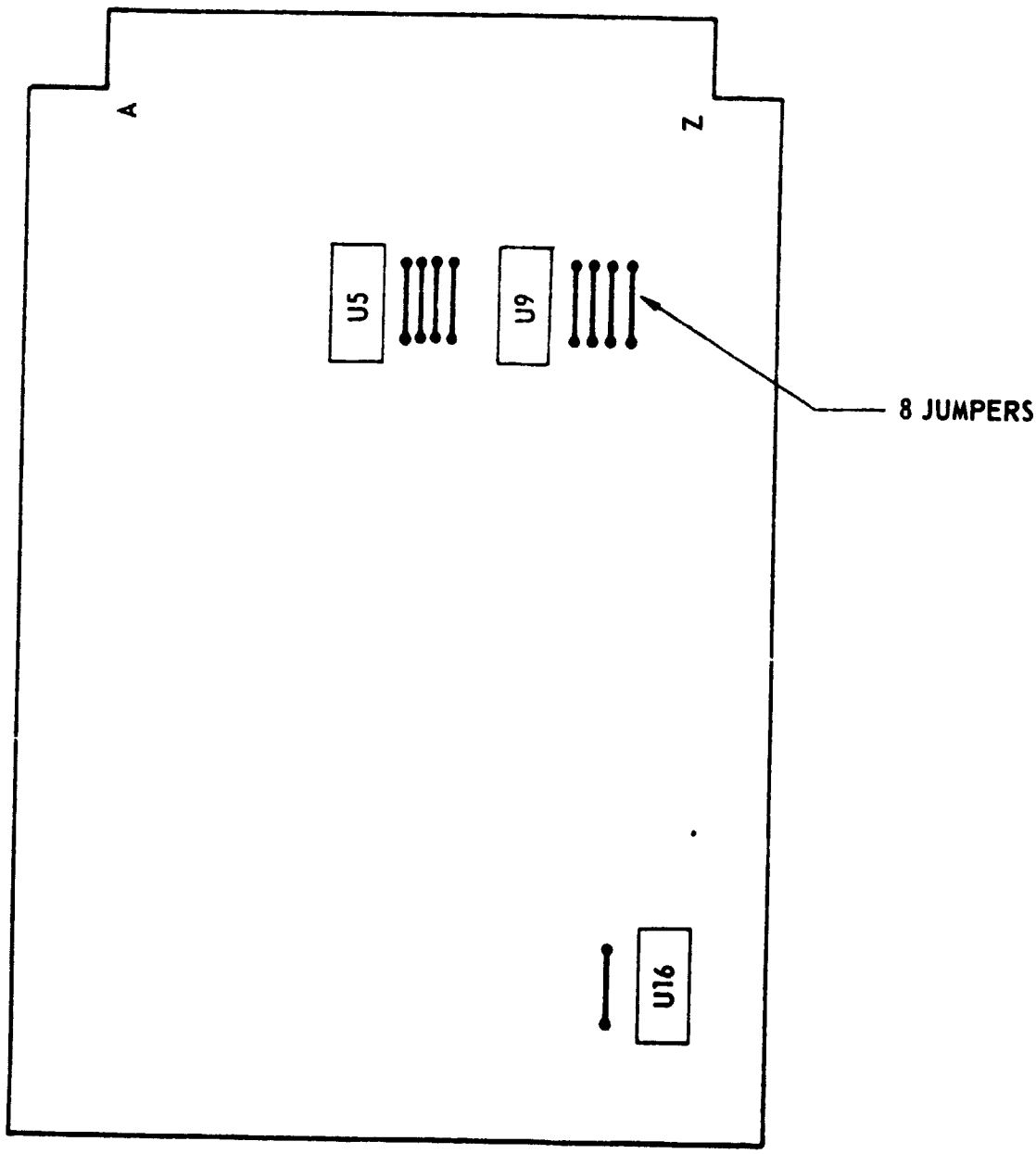


Figure 16. — Wang control.

3.2.7 Wang Control

See figure 15. The correct device code select configuration is hard wired into the Wang control board via jumper wires, connecting the appropriate pins of U5 and U9 to either 5 volts or to ground. In reference to the logical drawing diagram SKD-LSX-0071, the input to U5 pin 4 is from the Wang calculator, and pin 10 of U5 is that bit which must be wired to 5 volts or to ground. Corresponding to that particular bit from the Wang calculator such that if U5-4 from the Wang calculator is a logical 1 level, then pin 10 of U5 must be connected to +5 volts and so on for the other three pins of U5 and for the four pins of U9 making up an 8-level device code select. An additional jumper is provided in defining whether the device code will be a group 1 or a group 2 command. By jumpering U16-9 to +5 volts, a group 1 command is defined and by jumpering U16-9 to ground, a group 2 command is defined.

4.0 THEORY OF OPERATION

4.1 GENERAL

The apparent complexity of the DAS can be explicated by examining the various functions separately. In the following discussion, refer to the block diagram drawing #SKD-LDX-0090 in appendix A. The data flow through the system is of two types, scientific and navigational. Each type of data will be discussed separately.

4.2 SCIENTIFIC

The scientific data is defined as the information contained in the reference clock input and the VCO input.

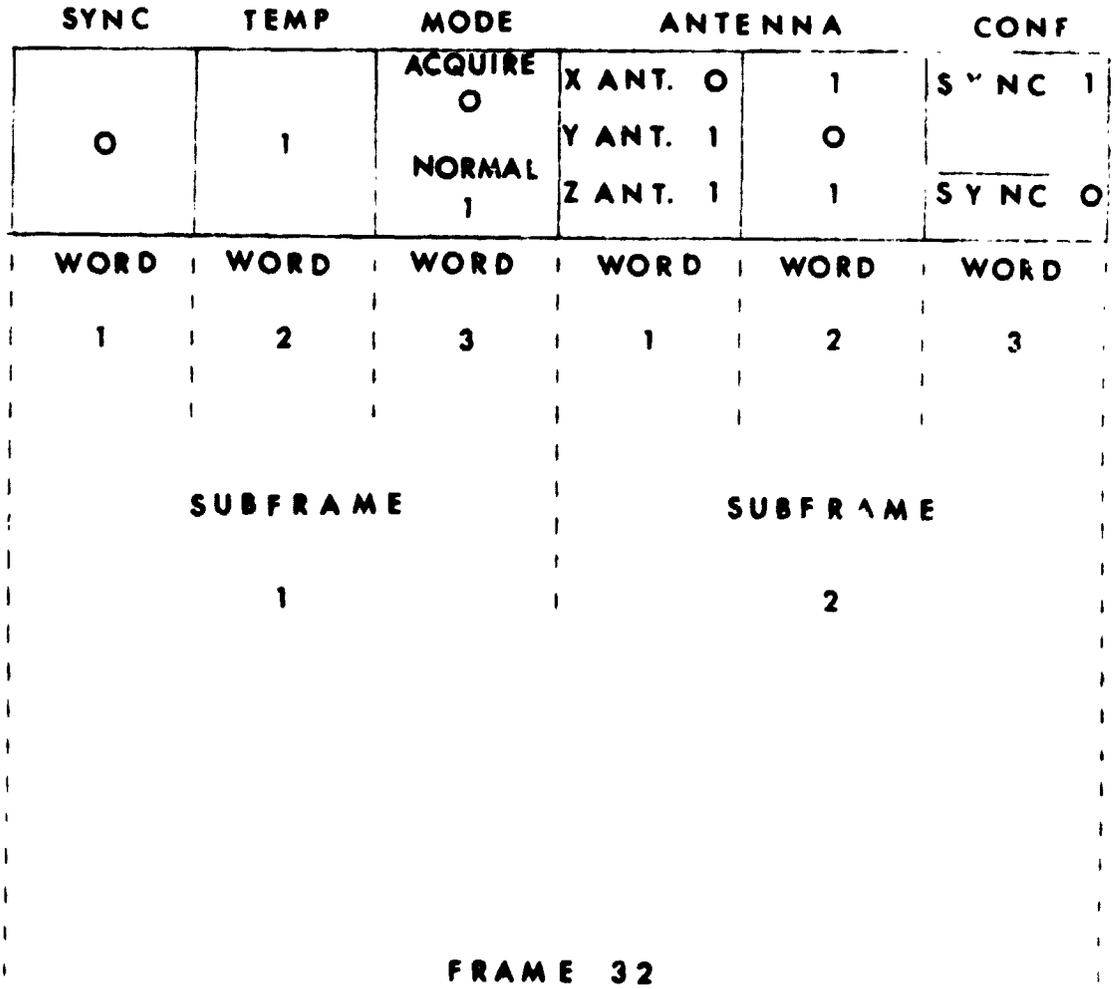
4.2.1 Input Conditioners

The input is converted from a variable input level to a square wave compatible with TTL circuits. Pc board 2-B performs this operation and distributes the conditioned data to the rest of the system.

4.2.2 Control Timing

Reconstruction of the basic timing sequence is performed by the control timing logic. Establishing the basic clock for the system is the first consideration. This is performed

by the system clock board, 5-B. Accuracy of the timing sequence is directly dependent upon the stability of the recorded reference clock and the reproducibility of the analog recorder. The system clock board is capable of multiplying the frequency of the reference clock by any number between 1.000 and 2.999. The correct multiplier setting is approximately 2. However, unknown variables require that the correct setting be found by trial and error. Once the correct system clock frequency has been determined the next step is identifying the start of the VCO data stream. Refer to figure 17. The synchronization detector (SY.DET.) board 1-T performs this function by continuously searching for no transitions of the VCO data. Once this zero transition period for the VCO has been found, a pulse is generated coincident with the beginning of the temperature word and then delayed until the end of frame 32. The delayed pulse, SYDET', is then applied to the word start board, 2-T, generating the word times and subframe times. The time of each word period is a function of the system clock and is derived by dividing the system clock by a programmed number. The time of each word should be 33.75 milliseconds.



0= No transition of VCO data

1= VCO frequency of current temperatures

Figure 17. – VCO data stream.

4.2.3 Data Calculation

Measurement of the VCO frequency and the reference clock frequency is performed by the pc boards 4-T, 5-T, 6-T, 7-T, 8-T, 9-T, 10-T, and 11-T. The VCO frequency is measured by time digitizing an integral number of cycles. Front panel controls allow the selection of the number of cycles to be measured (1 to 7) and the accuracy of the time period (1 μsec or 10 μsec). At the beginning of each word time, a gate period is enabled, and with the first positive transition of the VCO data, the gate is set. This gate is reset with the positive transition of N + 1 cycle of the VCO. The gate period is then measured by a crystal controlled clock of 1.0 MHz or 100.0 kHz. Counting the number of clock cycles contained in the gate period, results in a measure of time. The VCO gate period is used to generate an additional gate for the reference clock and is timed in the same manner as discussed above. During the reference clock gate period, the number of reference clock cycles is also counted, so that an accurate measurement of the reference clock frequency can be made.

4.2.4 Data Multiplexing

All data collected from the VCO input and the accumulated values of the navigational data are routed through the

multiplexer to the memory. The multiplexer has three inputs: VCO data, navigational data, and general housekeeping data. Refer to Table II for time and definitions of the inputs. Pc boards 12-T through 27-T, 7-B, and 8-B comprise the complete multiplexer. Data is gated through one of three sets of four data input/output (I/O) boards with the COM signals, and is stored in the four data buff boards as 48 parallel data bits. The two 2 × 12 MPXR boards (7-B and 8-B) break the 48-bit word into two 24-bit bytes, such that with each data transmission there exists two serial (by byte) 24-bit bytes for storage into the memory.

4.2.5 Data Memory

The memory consists of a series/parallel network of first-in-first-out (FIFO) shift registers configured as a 24 by 390 bit memory array. Six pc boards (9-B-14-B) are used to make up the Data Memory. Control of the memory is accomplished by pc card 6-B, MEM IN CONT. Assuming that the memory is initially cleared, data is first stored at SY.DET. time with 380 stores per frame. As data is placed into the memory it is automatically stacked into sequential 24-bit bytes. Beginning with the next SY.DET. pulse the previously stored data is shifted out of the memory byte serially under the control of pc Board 21-B, MEM OUT CONT, and presented to

the Wang 700 and digital tape interface logic. The MEM OUT CONT board "looks" at the 379th byte and checks four unique bits for correctness, and if this test fails, it will place the system in the Prime Mode resynchronizing to the next sync time.

4.2.6 Wang 700 Control

All information from the Data Memory is presented to a Wang 700 calculator for real time processing. It is important to note that the Wang cannot be interrupted by any external equipment, therefore, the stored program must be such that the Wang is waiting for data input. Pc cards 15-B and 16-B contain logic for the interface between the DAS and the Wang calculator. The logic is designed such that the Wang must have requested data before the data has started to shift out. The stored data is sent to the Wang calculator as 6 binary coded decimal (BCD) digits. The calculator then has 2 milliseconds to request another data word without losing any information. Complete data transfer is accomplished in approximately 3 seconds, leaving an additional 3 seconds for manipulation before the next data block is ready for output.

TABLE II. TIME AND DEFINITION OF INPUTS

Commutation Times

COM 1	1 - 1 - 1 to 32 - 1 - 2*
COM 2	32 - 1 - 3
COM 3	32 - 2 - 1 to 32 - 2 - 2
COM 4	32 - 2 - 3

*All frame, subframe, and word times are inclusive.

Multiplexer Output

COM 1	VCO Data
COM 2	NAV Data
COM 3	Not Used
COM 4	Housekeeping

Definitions

VCO Data	= VCO gate period, reference clock gate period, reference clock cycles.
NAV Data	= Accumulated values of range, bearing, odometer.
Housekeeping	= VCO cycles, gate delay, RCVR conf., mode, prime, run no., Wang 700 sync.

4.3 NAVIGATION

Navigational data and timing information are contained in one data channel, TCD. The TCD input is brought into the DAS via the input conditioner board and is then distributed to other circuits within the DAS.

4.3.1 Data Reconstruction

Pc board 3-B receives the TCD data and converts the signal to a TTL compatible signal. The navigational data is contained in the FSK signal of 4175 and 4625 hertz representing a logical "one" and "zero" respectively. To decode the FSK signal a phase lock loop system is employed to track the two frequencies and detect the change in frequency. The detected signal is then passed through a Schmitt trigger circuit to shape it and is then presented to the system as a serial pulse code modulated (PCM) signal.

4.3.2 Synchronization

Synchronization of the PCM signal is performed by pc board 4-B. Once the data is synchronized to an internal clock the six bits of data are brought out on parallel lines

for storage into the NAV Memory which is similar to the Data Memory. There are two modes of operation for storing the NAV Data:

1. The system will "look" for the sync pulse, lock into the data, and output the six bits of information each time sync is established. This mode has the disadvantage of losing information if sync is lost for the period of time required to reestablish sync.
2. The second mode of operation will output data every six-bit times. The disadvantage here is that the bit position value is lost and detailed analysis of the data is required to recover the information. Since each navigational data frame contains six bits of data plus one bit of sync (seven bits total), and since there are only six output data lines, the data is rotating on the lines due to the sync pulse being brought out along with the data.

In addition to the above, a synchronized frequency of approximately 88.8 Hz is available to develop the system clock.

4.3.3 NAV Memory

The NAV memory pc card, 18-B, is interchangeable with any of the data memory cards. Only six of the possible

eight parallel inputs are used and the memory is only 195 bytes deep resulting in a 6 × 195 bit memory. Data input to the memory is controlled by pc card 6-B, MEM IN CONT, which stores each six bits of data as it is presented by the NAV board, 4-B. The stored data of the Nav Memory is read out under control of the MEM OUT CONT board, 21-B, at the end of each readout cycle of the Data Memory. It is important to note that the Prime Mode does not clear the NAV Memory. However, the NAV Memory can accumulate approximately 15 seconds of data, which allows the system to miss one complete data block without the loss of any navigational information.

4.3.4 Navigation Accumulators

Range, bearing, and odometer information from the navigational channel is accumulated in three separate scalers, displayed on front panel numeric readouts, and used as an input to the Data Memory. The range and bearing scalers will either count up one with an increment pulse or count down one with a decrement pulse with a capacity of 3 full decades. A front panel selection switch selects either the front or rear LRV wheel for input to a six-decade scaler to accumulate the odometer pulses. All three sets of scalers may be preset to any number from the front panel controls. One additional scaler is used to count the navigational data

transfers from the navigational memory during the data taking period. This count is then transferred to digital tape, allowing the program to look at the correct number of navigational transfers stored on digital tape.

4.4 DIGITAL TAPE OUTPUT

All data processed by the DAS is digitally recorded on a Cipher 100H, seven-track, 556 BPI digital recorder. For complete operating procedures for the recorder refer to the tech manual for the Cipher 100H recorder. Table III gives the format of each record on the digital tape and lists the sequential steps as they would occur on the tape. All steps of the tape consist of a seven-bit byte where one track, C, is the lateral odd parity bit as generated by the digital recorder. Except for the navigational data all of the steps consist of a BCD digit located in tracks 1, 2, 4, and 8 with tracks A and B suppressed to zero. The navigational data is recorded in six-bit bytes on tracks 1, 2, 4, 8, A, and B for 195 steps of the recorder. Each of the recorded records contains all the information in one 32-frame data block.

Table III also describes the format of the data sent to the Wang 700 calculator. The data is sent to the calculator in groups of six BCD digits per transfer simultaneously with

TABLE III. — TAPE FORMAT AND SEQUENTIAL STEPS

V_2	V_1, V_2, V_3, V_4, V_5, = VCO duration
V_3	R_2, R_3, R_4, R_5, = 5.2 kHz duration
V_4	N_1, N_2, N_3 = 5.2 kHz cycles
R_2	
R_3	R_1 must be inferred to equal V_1.
R_4	
REPEATS 188 TIMES	
N_1	
N_2	
N_3	
R_5	
V_1	
V_5	
R_1	R_1, R_2, R_3 = Accumulated range
R_2	B_1, B_2, B_3 = Accumulated bearing
R_3	
3_1	
B_2	
B_3	
G	G = VCO gate cycles
D_1	D_1, D_2 = Gate delay × .1 milliseconds
D_2	R_1, R_2 = Run number
R_1	S = Sync status (DAS Resync)
R_2	
S	

TABLE III. — TAPE FORMAT AND SEQUENTIAL STEPS - Continued

T_1 T_2 T_3	T_1, T_2, T_3 = Relative elapsed time × .1 seconds
W	W = Wang sync = $11_{\{10\}} = 13_{\{8\}}$
C	C = Receiver resync
M	M = Receiver mode
D_1 D_2 1 1 D_{194} D_{194}	Navigation Data Di = B_6, B_5, B_4, B_3, B_2, B_1 Where Bi are NAV bits
N_1 N_2 N_3	N_1, N_2, N_3 = Number of significant Di's

DAS resync - 1 = Resync successful

0 = Resync not successful

Receiver resync - 1 = Resync successful

0 = Resync not successful

Receiver mode

M = 0 $\overline{Y}$ $\overline{X}$ $\overline{M}$ Receiver mode 1 - $\overline{M}$ = 1
Receiver mode 2 - $\overline{M}$ = 0

TABLE III. — TAPE FORMAT AND SEQUENTIAL STEPS - Concluded

X ant. on - $\overline{X} = 0$, $\overline{Y} = 1$

Y ant. on - $\overline{X} = 1$, $\overline{Y} = 0$

Z ant. on - $\overline{X} = 1$, $\overline{Y} = 1$

Note that RCVR MODE 2 indication is wrong if receiver resync was successful. RCVR will go into MODE 1.

the data transfer to the digital recorder, but stopping at the beginning of the navigational data.

4.5 DETAILED CIRCUIT DESCRIPTION

The following discussions will describe the operation of each type of pc card used in the DAS. Where more than one card of the same type is used in the system, only the logical function of that card will be discussed. Appendix B contains pin number assignments for each pc card in the system, and appendix A contains the detailed logic schematics.

4.5.1 Input Conditioner, Location 2-B, Drawing #SKD-LSX-0073

All inputs to the DAS are first brought into this board before being distributed to the rest of the system. The reference frequency, VCO, and an optional time input use the same type of circuit. Operation of only one of these channels will be discussed. The input signal is first ac coupled with a low frequency cut off of about 10 Hz to a linear operational amplifier with a manually controlled gain. The amplified signal is then presented to a bipolar Schmitt trigger circuit with a hysteresis of +2 volts producing an output that is TTL level compatible. The TCD input is similar to the above operation with the exception that it is not

passed through a Schmitt trigger circuit. Power of +12 volts for the circuits is produced by an onboard dc/dc converter.

4.5.2 Sync Det, Location 1-T, Drawing #SKD-LSX-0091

Initial system synchronization and resynchronization at the beginning of each data block is performed by this board. The system is placed in a search mode by depressing the front panel Prime switch, in doing this flip/flop (F/F) U9-12 is set, priming the system. F/F U13-3, $\overline{\text{Prime}}$, enables O/S U1 through U9-8 and O/S U2 through U6-3, allowing the 2 one-shots to detect the presence of a VCO input signal and to double its frequency through OR gate U5-6. IC's U3 and U4 form a down counter, counting down a count equal to 15.4 milliseconds by the system clock 10.4 kHz. VCO transitions continuously preset a count into U3 and U4 preventing them from counting down. If the VCO is absent for a period of 15.4 milliseconds, the first synchronization point on the data block is assumed to be present and U3 and U4 gives an output setting F/F U8-6. F/F U8-6 gives an output signal, Sync Status, informing the system that sync has been established and it also enables AND gate U7-11. The next transition of the VCO will occur at the beginning of the second word of the first subframe of frame 32. AND gate U7-11

allows this transition to set F/F U7-6. F/F U7-6 then enables AND gate U6-6 allowing the down counter made up of U14, U15, and U16 to be clocked by the system clock, 10.4 kHz, for a period of 169 milliseconds or the five remaining word times in frame 32. At the completion of the 169 milliseconds, the carry from the down counter is supplied to the system by OR gate U13-8 as the term SY.DET., also one-shot (O/S) U12 is triggered to reinitialize the circuit. The system is now in the sync with the data. Sync is reestablished every frame 32, subframe 1, word times 1 and 2 by AND gates U5-12 and U5-8 in the same manner as discussed above. AND gate U9-6 recognizes frame 32, subframe 2, word 3 time and inverter U13-11 produces a pulse coincident with the trailing edge and presents it to the system as SY.DET. if sync was not established. Counter U10 detects the second false SY.DET. signal and automatically places the system into the Prime mode.

4.5.3 Word Start, Location 2-T, Drawing #SKD-LSX-0060

As described above the data block is divided into 32 frames with each frame having two subframes and each subframe containing three word times. For simplicity we will describe a particular word as 7-2-1 where this would be

frame 7, subframe 2, and word 1. This board develops a timing pulse that denotes the start of each word time and discrete levels corresponding to the individual word times and subframe times. SY.DET. (1) resets a modulus 3 counter, U10, to zero which is decoded by one-of-ten decoder, U7, supplying word 1 to the system via U4-12, (2) triggers O/S U11 with the trailing edge which in turn resets F/F U9 supplying subframe 1 at U9-14, (3) supplies the first Word Start signal via OR gate U2-6, and (4) sets F/F U1-8. F/F U1-8 enables AND gate U1-6 supplying system clock, 10.4 kHz, to a modulus 351 counter consisting of U3, U5, and U8. The modulus 351 counter supplies an output every 33.75 milliseconds through OR gate U2-6 as Word Start and also increments the modulus 3 counter, U10. Decoder U7 decodes the three states of U10 as word 1, 2, and 3 and, at the end of word 3 time, toggles F/F U9 indicating a change between subframe 1 and 2. If at any time Prime occurs, F/F U1-8 is reset halting the generation of further timing signals until the next SY.DET.

4.5.4 Frame Decode, Location 3-T, Drawing #SKD-LSX-0092

Thirty two discrete outputs are supplied to the system corresponding to each of the frame times. A one-of-thirty-two decoder is used to accomplish this. The trailing edge

of SY.DET. fires O/S U2 which in turn resets counters U5 and U3. O/S U1 recognizes the trailing edge of subframe 2 producing a pulse that is counted by U5 and U3. Two one-of-sixteen decoders, U7 and U6, wired in parallel decodes 32 discretes states of the counter producing the unique output levels for each frame time.

4.5.5 VCO Gate, Location 4-T, Drawing #SKD-LSX-0093

It is desired to generate a time period within each word time of an exact integral number of VCO cycles delayed from the start of the word time by a programmable amount. To accomplish this, Word Start sets F/F U10-8 enabling AND gate U10-6 and releasing a reset from delay time counter consisting of U8 and U9. AND gate U10-6 then supplies a 10 kHz clock to the counter U9, counting at one count per 0.1 millisecond. Digital comparators U13 and U12 compare the number in the delay counter to a front panel selected delay between 0.1 and 9.9 milliseconds giving an output when the numbers match at AND gate U14-6, which then fires O/S U15 resetting F/F U10-8 preparing the delay counter network for the next Word Start, and sets F/F U2-6 enabling AND gate U5-11. O/S U11 detects the leading edge of each VCO cycle and produces a 100 nanosecond pulse setting F/F U2-11 via

U5-8, allowing the cycle counter to count the VCO cycles. The count contained in the cycle counter is compared by a digital comparator, U4, to a front panel selection of the number of cycles to be contained within the gate period. When the correct number of VCO cycles are obtained, O/S U3 is triggered via AND gate U5-3 resetting F/F's U2-11 and U2-6. F/F U2-11 now has been set and reset within each word time such that the set period is that of a selected integral number of VCO cycles. This period is presented to the system as VCO gate by OR gate U5-6 via AND gate U5-8. To insure that a gate period will exist during word times 32-1-1 and 32-1-3 through 32-2-3 when it is possible that no VCO transitions will occur, AND gate U6-8 is inhibited and AND gate U6-11 is enabled during these times allowing the gate delay period to act as a VCO gate through OR gate U5-6. Gates U6-6 and U6-3 decode that section of frame 32 as described above.

4.5.6 Data Available, Location 5-T, Drawing #SKD-LSX-0094

To establish a measurement of the reference frequency at the same time that the VCO frequency is measured a 5.2 gate period is generated by the VCO gate. O/S U5 detects the leading edge of each cycle of the 5200 Hz, F ref.,

generating a pulse of 60 nanoseconds, and supplies these pulses to one of the two inputs of AND gates U2-3 and U2-6. The VCO gate enables AND gate U2-3 and the complement of the VCO gate enables AND gate U2-6. With AND gate U2-3 enabled, the first 5200 Hz cycle will set F/F U1 6 which is reset then at the first cycle after the VCO gate period is over by AND gate U2-6, thus giving a 5.2 gate period of approximately the same period and time as the VCO gate. The 5.2 gate F/F U1-6 then enables AND gate U1-11 giving an integral number of 5200 cycles to the counters. Knowing the number of 5200 cycles and the period, an accurate calculation of the frequency can be made. Also if the F ref. is a stable source the tape speed error can be calculated and subtracted from the VCO data measurements. Word Start triggers O/S U4 delaying the pulse by a manually controlled delay that should be set to approximately 30 milliseconds. The trailing edge of O/S U4 triggers O/S U3 producing a 1 microsecond pulse, Data Avail' and its complement, flagging the system that data has been processed and is available for storage.

4.5.7 Clock Counter, Location 6-T, 7-T, 8-T, 9-T, Drawing #SKD-LSX-0095

This pc card was designed as a general purpose counter, therefore, this discussion will refer to general operation

and section 5.2 will have to be consulted for pin number assignments. AND gate U2-3 is enabled by one of its inputs while the signal to be counted is applied to the other input. Normally the VCO gate or the 5.2 gate will be the enabling signal and a front panel selectable 100 kHz or 1 Mhz will be the signal to be counted, or the 5.2 kHz will be the signal to be counted. In the case of the VCO gate and a 1 MHz signal, the count contained in the counter would equal the period of the VCO gate in microseconds. Knowing the number of VCO cycles that are in the VCO gate period, the frequency of a particular word time can be computed by dividing the number of cycles by the measured time of that period. At the beginning of each word time the signal Word Start triggers O/S U4 resetting the counter to zero.

4.5.8 Data Strobe, Location 11-T, Drawing #SKD-LSX-0097

As described in section 4.2.4 there exists three types of data multiplexed through the system. Refer to Table II for exact word times, definitions, and functions controlled by the three COM levels. Each of the three unique COM levels enables a set of two input AND gates allowing a particular data function through the multiplexer. AND gate U1-12 decodes word time 1-1-1 which is then inverted by U2-8

resetting counter U2. One-of-ten decoder U6 decodes the count contained in the counter U7, where the count of 0, 1, and 2 are decoded, inverted by U5-6, U5-4, and U5-2 and presented to the multiplexer as COM 1, COM 2, and COM 4 respectively. AND gate U1-8 detects word time 32-1-3 and AND U1-6 detects word time 32-2-3. OR gate U2-3 OR's these two signals together advancing the counter U7 to the counts of 1 and 2. AND gate U2-11 develops 188 strobe pulses by AND'ing COM 1 and Data Avail'. AND gate U4-6 develops 1 strobe pulse with COM 2 and the leading edge of word time 32-1-3 detected by O/S U3. AND gate U4-8 produces 1 strobe pulse with COM 4 and COM 4 Strobe. OR gate U4-12 OR's these three signals producing 190 Data Strobe signals to the system as data transfer signals.

4.5.9 Data I/O Location 12-T, 13-T, 14-T, 16-T, 17-T, 18-T, 20-T, 21-T, 22-T, 24-T, 25-T, 26-T, Drawing #SKD-LSX-0068

The multiplexer consists of three sets of four each of these pc cards. Refer to appendix B for the pin assignment versus function on each pc card. There are 12-2 input AND gates with 1 input of each gate common serving as an enable line. Each of the gates are of the open collector type and may be wired OR'ed. When a set of gates is selected the

the output is the ONE's compliment of the input. Drivers U2-6 and U2-8 enables the AND gates with a logical one input level.

4.5.10 Data Buff, Location 15-T, 19-T, 23-T, 24-T, Drawing #SKD-LSX-0069

Data from the multiplexer is temporarily stored in the four Data Buff pc cards. Refer to appendix B for pin number versus function of each card. The data strobe pulses from the Data Strobe card, section 4.5.8, provides a load pulse via drivers U2-6 and U2-8 to three four-bit latches. Each of the latches will hold the information present on the inputs with the high to low transition of the data strobe pulse. Pull-up resistors are provided for each of the 12 inputs that may be used as terminating resistors when the latches are fed by open collector type circuits. The output is presented as the ONE's compliment of the input data.

4.5.11 Mode Detect, Location 10-T, Drawing #SKD-LSX-0096

The mode of operation of the SEP receiver is determined by the Mode Detect card. In referring to figure 4.2.1, it is seen that word times 32-1-3, 32-2-1, 2, and 3 contains the information in question. Word time 32-1-3 contains the primary mode of the receiver where the normal mode, MODE 1,

is the data taking mode, and the acquire mode, MODE 2, is the search mode to obtain receiver lock. Word times 32-2-1 and 2 specify the antenna, X, Y, or Z, that the receiver is utilizing to obtain sync. Word time 32-2-3 contains information as to the sync status of the receiver. The four word times, 32-1-3, 32-2-1, 32-2-2, and 32-2-3, are detected by AND gates U4-8, U7-12, U7-8, and U7-6, respectively. OR gate U4-6 and the respective R-C differentiators detect the leading edge of each of the four word times and then sets F/F U1-8 via inverter U9-12. F/F U1-8 enables AND gate U1-3 supplying the system clock, 10.4 kHz, to counter U2 and U3. The counter of U2 and U3 supplies a set and reset pulse to F/F U6-6. U3-8, the set pulse, occurs 12.5 milliseconds after the start of each word and U3-11, the reset pulse, occurs 25 milliseconds after the start of each of the four word times. F/F U6-6 is now set for 12.5 milliseconds in the center of each of the four word times enabling AND U6-8 allowing any VCO transitions present during a particular word time to shift shift register U12. Shift register U12 will shift in "ONE's" flooding the register with "ONE's" until it overflows after four transitions of the VCO if the VCO signal is present. This circuit acts as a noise filter for spurious transitions. The overflow from the shift register sets F/F U11-10 via AND gate U5-10 enabled by word time 32-1-3

from AND gate U4-8. The above argument is valid for detecting a "ONE" during word times 32-2-1, 32-2-2, and 32-2-3 by F/F U5-4 and AND gate U5-13, F/F U8-10 and AND gate U8-1, and F/F U11-1 and AND gate U8-4 respectively. The outputs of the four flip/flops are presented to the output via the multiplexer as MDWD 1, MDWD 2, MDWD 4, and MDWD 8 for decoding by WANG 700 calculator. In addition to the above, the four flip/flops are decoded by the one-of-ten decoder U10 to drive front panel indicator lights.

4.5.12 Frame Counter, Location 28-T, Drawing #SKD-LSX-0098

All DAS processed data for one word time may be displayed on the front panel by selecting the Frame, Sub-Frame, and Word Number manually by front panel selectors. O/S U7 recognizes SY.DET. via inverter U4-12 resetting the frame counter U5 and U6. The frame counter U5 and U6 outputs are also presented to front panel LED numeric displays as well as the digital comparator U1 and U2. Front panel selector switches select one of the three word times and one of the two subframe times enabling AND gate U3-8. The digital comparator U1 and U2 compares the front panel selection of the frame desired and the frame number as derived from the counter U5 and U6. The data strobe pulse enables the digital comparator each word time, fully enabling AND gate U3-10.

AND gate U3-10's output, Data Display, is inverted by inverter U4-10 and used as a strobe pulse to a LED numeric display card to load the data from the multiplexer at the desired word time for front panel display.

4.5.13 Driver Inverter, Location 29-T, Drawing #SKD-LSX-0099

Three inverting/driving integrated circuits make up the power inverter pc card. U1 is of the inverting, open collector, high current type; U2 is a standard TTL inverter type, and U3 is noninverting, open collector, high current type. The high current drivers are used to drive front panel indicators and U2 is used for logic level inverters.

4.5.14 Crystal Clock, Location 1B, Drawing #SKD-LSX-0101

The crystal clock pc card is a dual purpose card, it produces eight decades of TTL level square wave frequency sources. The primary frequency source is a crystal controlled 10 MHz oscillator consisting of U10. U10 is an integrated circuit VCO configured such that voltage divider R1 and R2 applied to pin 2 of U10 sets the free running frequency to approximately 10 MHz. C3 and crystal Y1 then locks U10 into a crystal source of 10 MHz. U10 pin 6 is an

output of 10 MHz which is then divided by 10 consecutively by U9, U8, U7, U6, U5, U1, U2, and U3, for an output of 1 MHz, 100, 10, and 1 kHz, 100, 10, and 1 Hz respectively. U3 pin 11 triggers one shot U4 producing a pulse width of approximately 1 microsecond at a rate of .1 Hz.

4.5.15 FSK Board, Location 3-B, Drawing #SKD-LSX-0102

The raw navigation FSK signal is decoded by the FSK board to a TTL level compatible PCM data strain. The decoding of the data is performed in three steps: (1) the initial decoding of the FSK signal by a phase lock loop system, (2) integrating to eliminate narrow pulse widths from the phase lock loop system, and (3) finally by pulse width discriminating to insure that false pulse triggers do not trigger the decoding of the navigational data. A phase lock loop integrated circuit U1 is utilized to track the FSK input signal; resistor R7 is set such that the free running frequency of the phase lock loop integrated circuit U1 is approximately 4300 Hz. Pin 8 of U1 delivers either a 0 volt or a +5 volt output depending on the input. The output will be zero volts with an input of 4625 Hz or a logical zero, and +5 volts for an input frequency of 4175 Hz or a logical one input. This signal may be observed at TP2. Due to the characteristics

of the phase lock loop system, and the instability of the DSEA recorder, there exists many short frequency deviations through the system. To eliminate these signals an operational amplifier U2 connected as an integrator with an integration period of approximately 1 millisecond is utilized to eliminate the short duration pulses. The output of the integrator is delivered to amplifier U5 which offsets the output of the integrator such that the signal now appears as a sine wave about 0 volts, with a peak-to-peak amplitude of approximately 10 volts. This signal may be observed at TP3. U4 is a Schmitt trigger with a hysteresis of approximately 2 volts or ±1 volt. The output of Schmitt trigger U4 develops a compatible TTL level signal which is then inverted by inverter U7-11. The output of inverter U7-11 now has the appearance of a serial PCM data stream. However, again due to the instability of the DSEA recorder there may exist false logic levels, from the DSEA recorder. These signals are further discriminated by a pulse width discrimination circuit, such that the minimum pulse width recognized by the system must be at least 5 milliseconds or greater in length. The correct data format may be observed in figure 9. The output of inverter U7-11 enables AND gate U7-3. One shot U-12 recognizes the leading edge of the output of inverter U7-11. One shot U-12 is manually set for approximately 5 milliseconds by resistor R11. At the end of the

5 milliseconds or the trailing edge of the pulse from one shot U12, one shot U10 triggers, allowing the output to pass through AND gate U7-3 setting flip/flop U9-11 and also firing one shot U5-6. OR gate U9-8 passes the signals of both F/F U9-11 and one shot U5-6. One shot U5-6 is set such that the output pulse width is 7 milliseconds long insuring that if any pulse is detected that a minimum pulse width at the output of OR gate U9-8 will be at least 7 milliseconds in duration. The output of inverter U7-11 also triggers one shot U8 at the trailing edge time. The pulse width of one shot U8 is manually controlled by resistor R15 and is set for approximately 5 milliseconds so that at the end of the 5 milliseconds one shot U6 is triggered. If AND gate U7-6 has been enabled by inverter U7-8 which is the inversion of the non-return-to-zero (NRZ) data from inverter U7-11 or if the data is not present then flip/flop U9-11 is reset. Flip/flop U9-11 has now been set and reset. The pulse width of F/F U9-11 is the NRZ data from the inverter U7-11 delayed by approximately 5 milliseconds. This insures that the data is present for 5 millisecond from the leading edge of the firing of one shot U12 and has been absent for at least 5 milliseconds after the firing of one shot U9. In this manner any pulse width of less than 5 milliseconds has been eliminated. The output of OR gate U9-8 may be observed at TP7 which represents the true PCM navigational data stream.

4.5.16 NAV Board, Location 4-B, Drawing #SKD-LSX-0103

The serial PCM data stream from the FSK board is decoded and converted from a serial to a parallel format. An 88.8 Hz clock that may be used to develop the system clock is also provided. To convert the PCM serial stream to a parallel format, an internal clock must be first synchronized to the PCM data strain. This is performed by synchronizing a much higher frequency oscillator to the phase of the PCM data. U10 forms a crystal controlled oscillator operating at a frequency of 364.089 kHz which is a multiple of 88.8 Hz. The output of U10-8 is buffered by inverter U10-10 and is continuously divided by 4,096 by counters U13, U12, and U9. With the positive transition of each PCM data transmission, one shot U11 is triggered producing a pulse width of approximately 80 nanoseconds which then resets the dividing counter U13, U12, and U9 forcing the output of U9-7 to a zero. Concurrently, with this the positive transition of the PCM data stream is presented to D-flip/flop U8-2, with the clock being provided by counter U9-7. D-flip/flop U8 shifts with the positive transition of its clock input. With the counter now set to zero and the output of counter U9-7 being a division of 364.89 kHz down to 88.8 Hz (which is the frequency of the PCM data) it is known that in 1/2 of a bit time the

clock will change from zero to a positive 1 level, thus shifting in the PCM data into the D-flip/flop U8-5. Now the clock from counter U9-7 has a phase that is changed to that of the incoming PCM data stream and with each succeeding PCM positive transition one shot U11 triggers resetting the counter reestablishing the correct phase of the internal clock to the D-flip/flop U8. The clock then is presented to a shift register U5, U1, and U4 along with the synchronized data from the D-flip/flop U8-5. AND gate U6-6 decodes the four sync pulse levels that must be present. These are decoded from the shift register U4-13, U4-3, U1-4, U5-5. If the four sync pulses are present, U6-6 will produce an output, which is then inverted by U10-4 and partially enables AND gate U6-8. AND gate U6-8 then decodes multiples of the 88.3 kHz to develop a strobe pulse that is located in the center of a PCM data bit time. The output of AND gate U6-8 is then presented as an input to one switch position of S1 as a TCD strobe signal. This strobe signal is used as a strobe to load the NAV data into a memory and to count the transfers of TCD data into memory. During the TCD strobe, shift register U4 contains the six bits of navigational information. In coincidence with the TCD strobe signal the parallel data will be present on the output of shift register U4 as the range plus, range minus, bearing plus, bearing minus, odometer front and odometer rear wheel pulses. One additional

feature that has been added to the NAV board is made up of counter U7. Counter U7 is simply a modulus 6 counter, counting the output of the clock and dividing this signal by 6. With each sixth clock signal, one shot U3-6 is triggered. The output of U6 is presented to one side of switch S1 and if selected is presented as the TCD strobe signal. This signal is used again to strobe six bits of information from shift register U4 as range plus, range minus, bearing plus, bearing minus, odometer front, odometer rear to the navigational memory and display circuits. The difference here is that the synchronization pulses are also presented to the system. The format of the output of the shift register U4 is non-repetitive in that one cannot predict the location of the sync pulse. However, all information is stored in the navigational memory and later written onto digital magnetic tape. Detailed computer analysis of the system can completely reformat the data and through programmed digital filtering techniques may better reestablish the true navigational data format.

4.5.17 Systems Clock, Location 5-B, Drawing #SKD-LSX-0104

System timing is developed for the entire DAS system by the system clock board from one of two possible sources: (1) 5.2 kHz referenced frequency input or (2) TCD clock 88.8 Hz

synchronized to the NAV data. Basic system clock frequency is 10.4 kHz. To multiply the input to 10.4 kHz a frequency synthesizer using a programmable phase lock loop system is utilized. The input to the system is determined by a jumper on the pc card. The TCD clock, 88.8 Hz is present at pin 3 of the pc card and the 5.2 kHz is present at pin C. By jumpering one of the two pins to pin 1 of U4 the selection is made. U4 is an integrated circuit phase comparator, with transistor Q1 and amplifier U4 pin 8 a low pass filter is formed supplying a dc voltage to the voltage controlled oscillator U6. U6 is set to a nominal free running frequency of 10 MHz by the feedback capacitor C24. The output of the VCO U6 is fed to a programmable frequency divider, consisting of U8, U9, U10, and U11, which may be preset to any sired multiplier from 1.000 to 2.500 such that the output of the VCO may be multiplied within the limit of these two numbers. The output of the frequency divider U11 pin 13 triggers one shot U7, which then resets the divider chain U8, 9, 10, and 11 to the modulus programmed by the switch assembly on the pc card. The output of one shot U7-8 is used as one phase to the phase comparator circuit to be compared against the input signal. The output of the VCO is then divided by an additional divider chain consisting of U1, U2, and U3 which is a fixed divide by 1,000. The

output of U1 is inverted by buffer U5-6 and presented to the system as system clock, 10.4 kHz. As an example let us choose an input to the phase comparator of 5.2 kHz and choose to multiply the 5.2 kHz by 1.990, giving us a desired output frequency of 10.348 kHz. Phase comparator U4 compares the phase of the 5.2 kHz to that of one shot U7, thus developing an analog voltage at U4-8 forcing the VCO U6 to change frequency. The frequency will continue to change until the output of U7 is 5.2 kHz. The frequency output of U6 is then divided down by counter chain U8, 9, 10, and 11 by a factor of 1990 and is fed back to U7 and the phase comparator U4 in order to stabilize the loop at 5.2 kHz. To supply 5.2 kHz to the phase comparator, the VCO output must be operating at a frequency of 52 × 1990 because of the presence of the counter chain. This gives us the multiplication of 5.2 kHz by 1990. This in turn gives us an output of the VCO of 10.348 MHz. The fixed divider chain U1, 2, and 3 divides the 10.348 MHz by 1000 developing the 10.348 kHz signal through the driver U5 as the system clock output.

4.5.18 Memory In Control, Location 6-B, Drawing #SKD-LSX-0105

Control of the input to both the Data memory and the NAV memory is performed by the Memory In Control pc board. The following discussion will cover each section independent of the other.

4.5.18.1 Drawing #SKD-LSX-0105, sheet 1. Both the NAV memory and the Data memory are two phase clock systems. The clock frequency is 10 kHz. The 10 kHz is developed by the crystal clock board and picked off the 10 kHz tap. One shot U11 recognizes the trailing edge of each of the 10 kHz cycles. The output of one shot U11-8 is then level converted to a MOS logic level of -12 to +5 volts and is presented as phase 1. One shot U12 recognizes the leading edge of each 10 kHz cycle and is level converted to MOS levels of -12 to +5 volts and is presented as phase 2. Phase 1 and phase 2 clocks each are approximately 1 microsecond in duration with no overlap of each other. Phase 1 and phase 2 clock to both the NAV memory and the Data memory run 100 percent of the time. As stated above, the scientific information is delivered to the system as a 48-bit data word. The Data memory, however, is arranged as a 24-bit wide memory system. Therefore, a multiplexing of the data from 48 bits

to two 24-bit words is required. The data strobe signaling the system that scientific data is ready for storage is recognized by one shot U5-8. The output pulse width of one shot U5-8 is approximately 1 millisecond in duration. U5-8 output partially enables AND gate U3-3. OR gate U3-11 differentiates the leading edge of one shot U5-6 developing an approximate 50 nanosecond pulse setting flip/flop U9-5 via inverter U3-8. Shift register U9-9 makes up a one bit shift register that will shift the one level of flip/flop U9-5 to its output with the next positive transition of the 10 kHz clock synchronizing the data strobe pulse with the 10 kHz signal. Shift register U9-9 output completely enables AND gate U3-3 which is then inverted and buffered by driver U2-8 to be used as a commutation level for the first 24 bits of the 48-bit scientific data word. With the next transition of the 10 kHz clock U9-9 returns to the zero level. At the trailing edge of U5-8 one shot U6 is triggered. U6 partially enables AND gate U3-6. OR gate U3-11 differentiates the leading edge of one shot U6-6 again developing an approximate 50 nanosecond pulse setting flip/flop U9-5. Again with the first positive transition of the 10 kHz signal the output of U9-5 is shifted into U9-9 immediately resetting flip/flop U9-5, and at this time U9-9 fully enables AND gate U3-6 developing a second COM level to strobe in the second 24 bits

of the 48-bit scientific data word. The two pulses developed for each data strobe input signal by shift register U9-9 are presented to the data memory as READ INPUT which actually stores the two 24-bit data words into the memory.

4.5.18.2 Drawing #SKD-LSX-0105, sheet 2. The input to the NAV memory is controlled by this section of the Memory In Control board. The operation is very similar to that of the Data Memory Control board. The TCD strobe signal developed by the NAV board is detected by inverter U1-6, then differentiated to an approximately 50 nanosecond pulse setting flip/flop U8-5. With U8-5 set, the next positive transition of the 10 kHz signal is used to shift a one level into shift register U8-9, and with the next positive transition of the 10 kHz signal shift register U8-9 returns to a zero level. The output of U8-9 is then delivered to the NAV memory as READ NAV INPUT and this signal is used to write the contents of the navigational data into the NAV memory. The $\overline{Q}$ side of flip/flop U8-8 is inverted by inverter U7-11 enabling AND gates U4-8, U4-11, U7-6, U7-3, U4-3, and U4-6 which allows the six navigational data bits to be presented to the memory via drivers U1-12, U1-10, U1-8, U7-2, U1-2, and U1-4 as six navigational data bits. The navigation memory is arranged as a 6-bit wide memory system with a range plus,

range minus, bearing plus, bearing minus, odometer front, odometer rear pulses being presented to the memory as NAV 1, NAV 2, NAV 3, NAV 4, NAV 5, and NAV 6 respectively.

4.5.19 Two × Twelve Multiplexer, Location 7, 8, 19, 20B, Drawing #SKD-LSX-0107

The 2 × 12 multiplexer board is a dual purpose multiplexing system, consisting of a 24 wide, 12 dual, 2 input AND/OR gates. The logic is arranged such that one of two inputs enables 12 AND gates and the corresponding input of the two input AND gate is routed to the output. As can be seen by the schematic, pin 3 or TP2 is bussed commonly to 12 of the 2 input AND gates and pin C or TP1 is bussed commonly to the other 12 two input AND gates. For example if pin 3 is brought to a logically one level, the information at pin 13 of AND gate U3 is presented to the output of U2-8 or pin K of the pc card, and also if pin C is at logical one, pin 10 of U3 or pin M of the pc board is presented to the output of the inverter U2-8 or pin K of the pc board. For a listing of pin number assignments versus function assignments refer to appendix B. There are two places of usages for the 2 × 12 multiplexer, one as just described in section 4.5.18, Memory In Control. When the scientific 48-bit parallel data word is to be written into the Data

Memory the two terms described, Data 1 and Data 2, first permits 24 bits of the 48-bit word to be written into memory as a 24-bit parallel word, and then the second 24 bits is written into the memory as a parallel word. The second place that the 2 × 12 multiplexer is used is in the output of the NAV memory and the Data memory in routing the data to the digital tape recorder.

4.5.20 8 × 195 Memory, Location 9, 10, 11, 12, 13, 14, and 18-B, Drawing #SKD-LSX-0108

The 8 × 195 Memory consists of a series network of individual first-in-first-out (FIFO) shift registers. Each of the FIFO shift registers is configured as an 8 × 13 bit memory. There are 15 of the FIFO shift registers connected in series per pc board, thus providing each pc board with a register equivalent to 8 × 195 bits. To form the Data Memory, six cards are required. The first three cards are connected in parallel giving a 24 × 195 bit shift register, and three additional cards are connected in series expanding the memory to 24 × 380 bits. These six cards for the Data Memory are located in 9B, 10B, 11B, 12B, 13B, and 14B. For the NAV data memory only one card is required. It contains 8 × 195 bits. However, two of the parallel input bits are not used. Therefore we effectively have a 6 × 195 bit

Navigational memory. As stated above each shift register is a two-phase clock system. The operation of the memory is such that any time there is a data or logical one level present on any of the eight inputs, an eight-bit byte is loaded into the register or if there is a REAL INPUT at pin 20 of U1 the eight parallel bits are read into the memory. Operation of the memory is such that when an eight-bit byte is read into the memory, it is sequentially shifted toward the output until it reaches the output, or until it comes to the last byte that was stored into the register and there it will stop. Each register has a REGISTER EMPTY signal. The REGISTER EMPTY signals to the following register that the latter register is to accept data. The REGISTER FULL feeds information to the preceding register informing that register that it is to accept data. The final stage of each memory on pin 15 is the SHIFT OUT command. The SHIFT OUT command when brought to a logical one level transfers data sequentially out of the memory at a 10 kHz rate. However, if the SHIFT OUT command is one 10 kHz clock cycle wide, only one 8-bit byte will be shifted out of that respective memory. The direction of flow of information through the memory by IC number is U1, U2, U3, U4, U5, U10, U9, U8, U7, U6, U11, U12, U13, U14, and U15. Appendix B gives the pin assignment versus the logical function for each of the 8 × 195 bit

pc cards. For more detailed information on the integrated circuits refer to appendix C.

4.5.21 Wang Control, Location 15B and 16B, Drawing #SKD-LSX-0072 and SKD-LSX-0071

In the following discussion it will be assumed that the reader has a knowledge of the operation of the Wang 700 calculator. Detailed operation of the calculator will not be discussed in this manual, however, as a reminder, external peripheral equipment cannot interrupt the Wang 700. The calculator must request information into its register, and then once the information has been requested the peripheral equipment must initiate a GO command back to the calculator to release the calculator from that peripheral equipment. Also many peripherals may be tied to the same I/O data buss of the calculator. The selection of an individual piece of equipment is made by the Device Code Select. This is eight-level code input that must be decoded. If the selection of an individual peripheral compares to that of the eight levels on the Device Code Select line, then that particular peripheral has been selected for input into the Wang. Operation of the Wang control will be covered in two sections. The first section will be the basic control or device selection of the peripheral equipment; the second section will be the data multiplexing to the Wang.

4.5.21.1 The Device Code Select. The Device Code Select is performed by U5 and U . Any device code ma; be programmed via jumper wires on pc card 16B (drawing #SKD-LSX-0071). With the desired device code select programmed into the jumper wires on the pc card, these eight lines are then applied to digital comparators U5 and U9. Inputs to comparators U5 and U9, pin 4, 3, 2, and 1 on each IC are tied directly to device code select lines from the Wang 700. If the device code compares, AND gate U13 is enabled, then inverted by inverter U16-4 partially enabling AND gate U12-8 and 12. The next level of selection of the device code is a group 1 or group 2 command. This is also programmable by a jumper wire on the pc card. If a group 1 is selected, then AND gate U12-8 is directly enabled and U12-12 is inhibited. If group 2 is selected, AND gate U12-12 is enabled and U12-8 is inhibited via inverter U16-8. Input to AND gate U12-9, is also tied to the Wang device code select line. With pin 9 of AND gate U12 high, a group 1 command is decoded at U12-8. Inverter U16-10 inverts this selection enabling AND gate U12-12 if a group 2 command is selected by the Wang calculator. Or gate U12-6 will OR the output of AND gate U12-12 or AND gate U8-8. U12-6 also enables the data output lines of the data multiplexing card 15B ia signal line labeled DATA ENABLE. The Wang calculator allows

the device code line to settle and then initiates a strobe pulse labeled WSTB28, which is inverted by U16-6 fully enabling AND gate U8-8 and which then sets flip/flop U4-8. This is the time when the calculator is now ready to accept data. Flip/flop U4-8 has now partially enabled AND gate U8-11. At the first strobe period, AND gate U8-11 will allow the strobe signal to set flip/flop U11-6 and pass through OR gate U11-11 advancing counter U14 to a count of 1. The trailing edge of the output of OR gate U11-11 triggers one shot U6-8, which is then inverted by inverter U8-3 sending to the Wang calculator the signal termed STB29, and which is used by the Wang calculator to strobe the input data lines into its register. In the event that something has prevented the calculator from requesting data and as a warning to the operator that data has been lost, a warning signal has been supplied by the circuit. The two-bit shift register consisting of U3-15 and U3-10 has a capacity to store two strobe signals. The two-bit shift register is reset at the end of each of the data transmissions to the Wang calculator. If however, (1) the first strobe signal is set into the 2-bit shift register and a data transmission was not started due to the Wang calculator not requesting a data transfer by the term WSTB28, and (2) a second strobe signal arrives, shift register U3-10 will go to a logical zero level setting flip/flop U4-6.

The setting of U4-6 enables a cross-coupled one shot pair made up of U-2 and U7 as a 500 millisecond duty cycle oscillator which is connected to a light driver and provides a warning as a red flickering light on the front panel. This light labeled Program Error may only be reset by manual intervention by front panel operation. This light serves as a warning to the operator that data has been lost and that a full transmission of all information to the Wang has not been established. This does not destroy continuing sending data to the Wang, even though the synchronization of the data transmission may have been lost. One shot U15 recognizes the busy signal from the Wang calculator labeled GKBD. On the positive transmission of each GKBD term the calculator is signalling the peripheral that it is no longer busy. As a Wang recognizes the term WSTB9 to write data into its register, the GKBD signal is brought to a zero level, signalling busy. Once the character has been stored in the register the GKBD line is released and returned to a positive level. This positive transition is recognized by U15-8. U15-8 produces a pulse through AND gate U11-8 which has been enabled by flip/flop U11-6. The output of AND gate U11-8 is then sent through OR gate U11-11 and then is counted by counter U14. The trailing edge of the output of OR gate U11-11 triggers one shot U6. U6-8 is then inverted and sent to the

Wang calculator as a second WSTB9 signal which writes the second character into the Wang register. This procedure continues until counter U14 reaches the count of six. At the count of six, AND gate U13-6 decodes this count firing one shot U10. One shot U10-8 resets the counter to a count of zero. One shot U10-6 resets flip/flop U11-6 preventing additional GKBD signals from being recognized, resets flip/flop U4-8 inhibiting further WSTB28 strobe signals from the Wang, and resets the two-bit shift register U3-15 and U3-10. One shot U1 recognizes the trailing edge of one shot U6 which is the WSTB9 signal to the Wang calculator. The output of U1 is the signal to the data multiplexing board termed ROT (rotate), which selects the next data character to be transmitted to the Wang calculator. This signal will be further discussed in the next section.

4.5.21.2 Wang data. Refer to Drawing #SKD-LSX-0072, board 15B for the following discussion concerning the data transmission to the Wang calculator. This board which has the capacity of storing six decades of information and is controlled by board 16B, and transmits all information required to the Wang calculator. The six decade buffer accepts data from the memory out at the strobe time; so all data going to the Wang calculator has been stored in the memory and has been read out of the memory and transferred

to the calculator in real time. The input is a parallel 24-bit data buss. Each of the 24 bits is broken down into 4 bits of a BCD character of six decades in length. Data transmission to the Wang calculator is serial by character, parallel by bit. U3-12 and 8 inverts the strobe signal to the storage buffers consisting of U6, U10, U14, U5, U9, and U12. The storage buffers are of a tristate logic level type. The three states consist of a logical zero, a logical one, or a high impedance state when the buffer is not selected. When the six decades are stored into the buffer, the information is held until the next strobe pulse moves the next six decades into the buffer. The output of inverter U3-12 and U3-8 also strobe into buffers U4, U8, and U7 a fixed program code. U4 has a code of 07 strobed into it with each strobe pulse. The 07 and the four BCD bits from the six-decade storage buffer comprise an eight-level code to the Wang calculator. Buffers U8 and U7 make up a GO command to the calculator which is transferred to the calculator at the end of its six-decade transmission, signalling the calculator that it is free from the data acquisition system. Inverter U3-10 inverts the signal from U3-12 and U3-8 resetting counter U16, forcing the counter to a count of zero. Decoder U15 decodes the count of zero and enables the buffer U13. Inverter U3-2 enables buffer U5 for the first six data transfers to the Wang calculator. The buffer U4 contains the

high order four-bit code to the Wang calculator and the six-decade buffer contains the low four bit levels thus making up the eight-level codes to the Wang calculator. The output of the six-decade buffer and U7 is ANDed with U1-8, 11, 6, 3 and the buffer U4 and U8 is ANDed with AND gate U2-11, 6, 8, 3. AND gates U1 and U2 are enabled by DATA ENABLE from board 16B. With the AND gates enabled and decoder U15 selecting the six-decade buffer U13, U4, and U13 are passed to Wang calculator as a high order and low order code of 07 for the high order code, and the BCD digit for the low order code. As stated above, the write signal WSTB9 to the Wang calculator has been presented to the calculator prior to the ROT signal. We have now written the first decade into the calculator register. When the calculator has accepted this decade, board 16B generates the term ROT. ROT is inverted via inverter U3-6 and advances counter U16 by a count of 1, selecting U9 of the six-decade buffer, supplying to the calculator the second decade of information to its register. This process is repeated until all six decades have been written into the calculator's register. With the sixth ROT signal, pin 4 of decoder U15 is enabled, U4 is inhibited and inverter U3-4 enables buffers U8 and U7. U8 supplies a high level order code of 05 and buffer U7 supplies a low order code of 14. This is sent to the calculator as a GO command.

When the calculator recognizes this GO command, it proceeds with the next programmed instruction and releases itself from the peripheral that it has addressed, in this case, the data acquisition system. AND gate U1 and U2 are of the open collector type and if this device has not been selected, these lines are held high and may be wired ORed to additional devices for expanding the number of peripherals that may be applied to the Wang calculator.

4.5.22 Mag Tape, Location 17B, Drawing #SKD-LSX-0077

As stated above, all information (scientific, navigation, and significant navigation transfers) is written on digital magnetic tape. The mag tape pc card performs this operation. It accepts information from the 2 × 12 multiplexer card after the NAV data, Scientific Data memory and the TCD count has been routed through the 2 × 12 multiplexer. Input to the mag tape card is 24 parallel lines. In this case the 24 parallel lines are broken into six BCD characters. The six decades are stored in a temporary memory buffer, that is made up of tristate logic latches. Each latch is four bits, and the output of the latches is of tristate levels, that is, standard TTL one or a logical zero or if the chip is not selected, the outputs are at a high impedance level.

Flip/flop U2-3 is forced to a continuous high state by tying pin B of pc card to +5 volts which is then inverted by U2-8 forcing flip/flop U2-3 to remain set. This enables AND gate U2-11 which passes each memory output strobe pulse through OR gate U5-8 strobing the data from the 2 × 12 multiplexer into the six decade storage buffer. The output of AND gate U2-11 also resets flip/flop U5-3. Flip/flop U5-3 goes to a logical zero level and removes a reset level from counter U12 allowing it to be advanced. Decoder U8 decodes the count of zero and decoder U8-13 enables the six decade buffer stage U10 making its output available to the tape recorder. Along with removing the reset level from counter U12 flip/flop U5-3 turns transistor Q1 off allowing the unijunction oscillator to start oscillating. The oscillator output is shaped by transistor Q3 firing one shot U9. One shot U9-6 is inverted by U5-6 and then presented to the tape recorder as a step and record pulse. The trailing edge of one shot U9-6 is detected by one shot U13 and then the trailing edge of U13-6 advances counter U12 which is advanced to the count of one and then is decoded by one of ten de-oder U8. U8-12 enables the decade buffer U6 which presents the next decade to the tape recorder. This procedure continues until the count of six is decoded by U8 at pin 4 resetting flip/flop U5-3 forcing counter U12 to 0 for the next operation, and turning transistor

Q1 on, preventing further oscillations of the unijunction oscillator. The output to the digital tape recorder is buffered via U1. Tracks A and B of the tape recorder are permanently tied to a logical zero level, tracks 1, 2, 4, and 8 are buffered by U1-10, U1-8, U1-2, and U1-4 respectively. The step and record to the recorder is buffered by U1-6. For detailed operation of the tape recorder refer to the Cipher 100H digital tape recorder technical manual.

4.5.23 Memory Out Control, Location 21B, Drawing #SKD-LSX-0109, Sheets 1 and 2

The memory out control board, controls both the Data memory and the Navigation memory. Operation of the Data memory is controlled by sheet 2 of 2 and the NAV memory by sheet 1 of 2 of drawing #SKD-LSX-0109.

4.5.23.1 Data memory control. In the following discussion we refer to sheet 2 of 2 of drawing #SKD-LSX-0109. Prime is used on the data memory to initialize the memory out control and also to clear the Data memory of all data. Prime is inverted by U2-11 and, via diode OR gate CR2, is ORed with the front panel memory clear through OR gate U6-11 bringing the shift out signal to the Data memory to a logical one level shifting all information from the memory out.

The 380 counter is counted down and produces an output at U3-13 which is differentiated by R3 and C5 resetting flip/flop U2-6. U2-6 then inhibits 1 kHz signals from passing through AND gate U6-3 to the modulus 6 counter U9. With U2-6 reset, the $\overline{Q}$ side of U2-8 resets the modulus 6 counter U9 to a zero level, initializing the counter for the next sync detect signal.

An additional feature is built into the data memory control in that the board is looking for a synchronizing change sign signal to the Wang calculator which occurs at a specific time during the data transfers from the memory. The recognition of this signal is described by the following discussion: One shot U8 is triggered by the read commands to the data memory via inverter U15-6, and then applied to AND gate U20-11. U20-12 is enabled by flip/flop U20-6. The U8 one shot output is then counted down by down counter U23, U22, U21, which comprises a 379 modulus down counter. The change sign data word to the Wang calculator should occur in the 379th data transfer from the memory. The detection of the change sign signal is made by digital comparator U19. One set of inputs to the comparator is permanently wired to the bit configuration of a change sign signal. The other set of inputs to the comparator is from the output of the

PRECEDING PAGE BLANK NOT FILMED

Data memory. The comparator then is enabled with each output of one shot U8, and if a comparison occurs, AND gate U15-8 is qualified and is then inverted by inverter U15-11. If flip/flop U20-6 has not been reset this pulse is then passed through AND gate U15-3 and diode ORed with the front panel prime switch. It should be remembered here that flip/flop U20-6 was initially set with SY.DET. and is reset after each 379th count by the down counter U23, U22, and U21. Thus the AND gate U15-3 is only enabled for the first 379 data transmissions from the Data memory. On the 380th transmission the change sign should give a comparator output and be presented to AND gate U15-3 but with flip/flop U26 reset by U21-13, prime will not be set.

4.5.23.2 NAV data memory control, sheet 1 of 2 of #SKD-LSX-0109. One shot U7-6 recognizes the trailing edge of the VCO data gate. When one shot U7-6 is triggered flip/flop U6-8 sets, supplying to the multiplexer a gate signal for multiplexing data from the NAV memory to the output. One shot U7-6 also presets a 195 down counter, consisting of U10, U14, and U18 and also sets flip/flop U11. With flip/flop U6-8 set AND gate U12-11 is enabled allowing a 1 kHz signal to pass through and be inverted by inverter U12-6 and then triggering one shot U17. One shot U17-8 is

delivered to the system as the NAV step signal and is also differentiated by capacitor C-9 setting flip/flop U16-5. Flip/flop U16-5 and U16-9 form a two-bit shift register that is used to synchronize the reading of the NAV memory with the 10 kHz memory clock frequency. With the flip/flop U16-5 set, the first positive transition of the 10 kHz signal shifts to a one into U16-9 and a zero into U16-5, and with the next positive transition, the zero from U16-5 is shifted into U16-9 giving one 10 kHz clock bit time out of U16-9. The signal from U16-9 is ANDed at AND gate U12-8 with flip/flop U11-9. If flip/flop U11-9 is set, U16-9 is passed through AND gate U12-8, inverted by U12-3 and is used as a shift signal to the NAV memory, reading the next NAV data word. Transistor Q1 monitors the NAV memory for a memory empty condition. If the memory is empty, transistor Q1 resets flip/flop U11-9, inhibiting AND gate U12-8, and preventing any further read commands to the NAV memory. This does not, however, inhibit the NAV step command or inhibit the NAV data gate. The operation of the 195 down counter U10, U14, and U18 continues until a count of 195 has been reached. At that time flip/flop U6-8 is reset inhibiting any further transfer of 1 kHz signals through AND gate U12-11.

4.5.24 TCD Control, Location 22B, Drawing #SKD-LSX-0111

This pc card is used to (1) read the significant NAV data transfers from the memory that has been accumulated in the scaler boards, (2) to buffer the data, and (3) to output three decades of information to the mag tape identifying to the software the significant number of NAV data transfers. The board also, at the conclusion of transferring the three decades of information, produces an inter-record gap command to the tape recorder, initiating the record gap, and setting the tape recorder ready for the next record. One shot U7 recognizes the trailing edge of the NAV data gate. U7-8 strobes information from the scaler board, containing the three decades of significant NAV data memory transfers, into storage buffers U3, U2, and U1. The trailing edge of one shot U7 is recognized by one shot U8. One shot U8 firing supplies a TCD clear pulse to the scaler board, resetting the scaler, initializing the scaler for the next accumulation of NAV data transfers. One shot U8-6 sets flip/flop U4-8. AND gate U4-11 is enabled by flip/flop U4-8 supplying 1 kHz clock signals to counter U9 and to AND gates U5-12 and U10-11. The count contained in counter U9 is decoded by one-of-ten decoder U6.

Decoder U6-2 decodes a count of one which enables the output of buffer U3 supplying the most significant decade to the tape recorder via the multiplexer 2 × 12 multiplexing boards. U6 pin 2 is also supplied to AND gate U5-12 via OR gate U5-6. When ANDed at U5-12 with the 1 kHz clock, it produces a TCD step pulse which is used as a step and record pulse to the magnetic recorder via inverter U10-3. The one-of-ten decoder continues decoding counter U9, such that U6-3 supplies the second most significant digit to the tape recorder and another step and record pulse. U6-4 selects the least significant digit to the tape recorder and develops the third step and record pulse. The count of six is decoded by one-of-ten decoder U6-7 which is then inverted by inverter U10-6 enabling AND gate U10-11. This allows one cycle of the 1 kHz clock frequency to be inverted by U10-8 and presented to the tape recorder as the inter-record gap command. U6-9 then decodes the count of 7 from the counter U9 resetting flip/flop U4-8 stopping the operation until the next NAV data gate time. U4-6 OR's the TCD gate and the NAV data gate forming an overall NAV gate signal. U4-8 is also supplied to the system as a TCD gate.

4.5.25 Up-Down Counter, Location 23B, 24B, 25B, 27B, 28B, and 30B, Drawing #SKD-LSX-0112

The up-down counter pc board is a general purpose pc board. It is used in five different circumstances. These include (1) the accumulation of the significant TCD or NAV data transfers to the memory. (2) accumulation of the range information, (3) accumulation of the bearing information, (4) accumulation of the odometer information and (5) accumulation of time. These locations are board numbers 23B, 24B, 25B, 27B, 28B, and 30B respectively. Refer to the wire list in appendix B for detailed pin assignment versus function. The pc card consists basically of three decades of up-down decade counters consisting of U2, U3, and U5. The three-decade counter may be externally preset to any number between 0 to 999, externally cleared, or may be counted up or counted down. Outputs from pc cards CARRY and BORROW are provided so that two cards may be cascaded. The CLEAR input, pin 7 of the pc card applied to pin 14 of the counters U2, U3, and U5 clears the content of the counters with an active high signal, therefore, if clear is not used pin 7 of the pc card must be kept at a logical zero level. The load signal is used to preset externally programmed input, into the counters, three decades of inputs are provided into the pc board.

Pull-up resistors are provided on the pc board if required by the external system. Load is accomplished by bringing pin 6 of the pc card to an active low signal. AND gate U1-6 and 8 control the function of the counter as to count-up or count-down. UP input to the pc card is on pin 3 and DOWN is on pin 6. These two inputs are of the active high type, up and down inputs must not be high simultaneously. If the counter is desired to count up, pin 5 of U1 must be in the logical one state and pin 10 of U1 must be in the logical zero state. With pin 5 high, AND gate U1-6 is partially enabled. Clock signals inverted by U1-11 pass through AND gate U1-6 and are applied to pin 5 of U2 so that each successive clock pulse is counted up. To reverse this operation one merely brings the UP input to a logical zero and raises the DOWN input to a logical one level. The CARRY output is inverted by U4-11 and brought out on pin 20 of the pc card. The BORROW output is inverted by U4-8 and brought out on pin 7 of the pc card. Parallel output of the counter is also provided by the pc card, in three BCD decades of information.

4.5.26 LED Driver/Buffer, Location 30T, 31T, 32T, 26B, and 29B, Drawing #SKD-LSX-0075

The LED driver/buffer board is a general purpose LED display driver. It was primarily designed to operate around

the OPCOA SLA1, LED numeric displays. However, the board will function with any LED numeric display that is of the common anode type. The pc card is equipped with a memory of six decades in length or 24 parallel bits of information. Normally the 24 parallel bits are broken into six BCD characters. The buffer is of the tristate logic level type. With the buffer not selected, the outputs will be at a high impedance level and when the buffer is selected normal TTL levels are delivered. The six decades of information are loaded into the buffer consisting of U5, U4, U3, U9, U8, and U7 by AND gate U2-11. Inputs to AND gate U2-11, Data Strobe 1 and Data Strobe 2, must both be at a logical one level. At a logical one level AND gate U2-11 is enabled, inverted by OR gates U2-8, U2-3 and U2-6 strobing the 24 parallel lines into the buffer. A free running unijunction oscillator derives the commutation frequency. Q1 is the unijunction transistor, operating at the frequency determined by resistor R1 and capacitor C1. Transistor Q2 shapes the output of the uni-junction transistor Q1, and is counted by counter U6. U10 is a one-of-ten decoder that decodes the count contained in counter U6. Operation of the system is continuous. When the count of zero is present in U6, U10-13 enables the outputs of buffer U5 to the seven-segment decoder driver and also turns on transistor Q3. With transistor Q3 on, current is

supplied to the common anode of the display; U1 sinks current from one or any combination of seven segments of the display. A 51 ohm limiting resistor is provided in each of the seven-segment input lines to the decoder. The LED numeric display completes the current path between the transistor Q3 and the decoder driver U1. The next oscillation of the unijunction transistor Q1 is counted by U6 which is then decoded by U10-12. U10-12 selects the second decade, buffer U4, to be decoded by the seven-segment decoder, U1. U1 also turns off transistor Q3 and turns on transistor Q4, supplying current to the second LED numeric display. This procedure continues for all six decades and then repeats. The frequency of commutation of the six decades of readouts may be increased or decreased by the selection of R1 and C1. A lamp test input is provided such that when it is brought to a logical 1 level all segments of the displays are illuminated thus giving a display of the numeral 8.

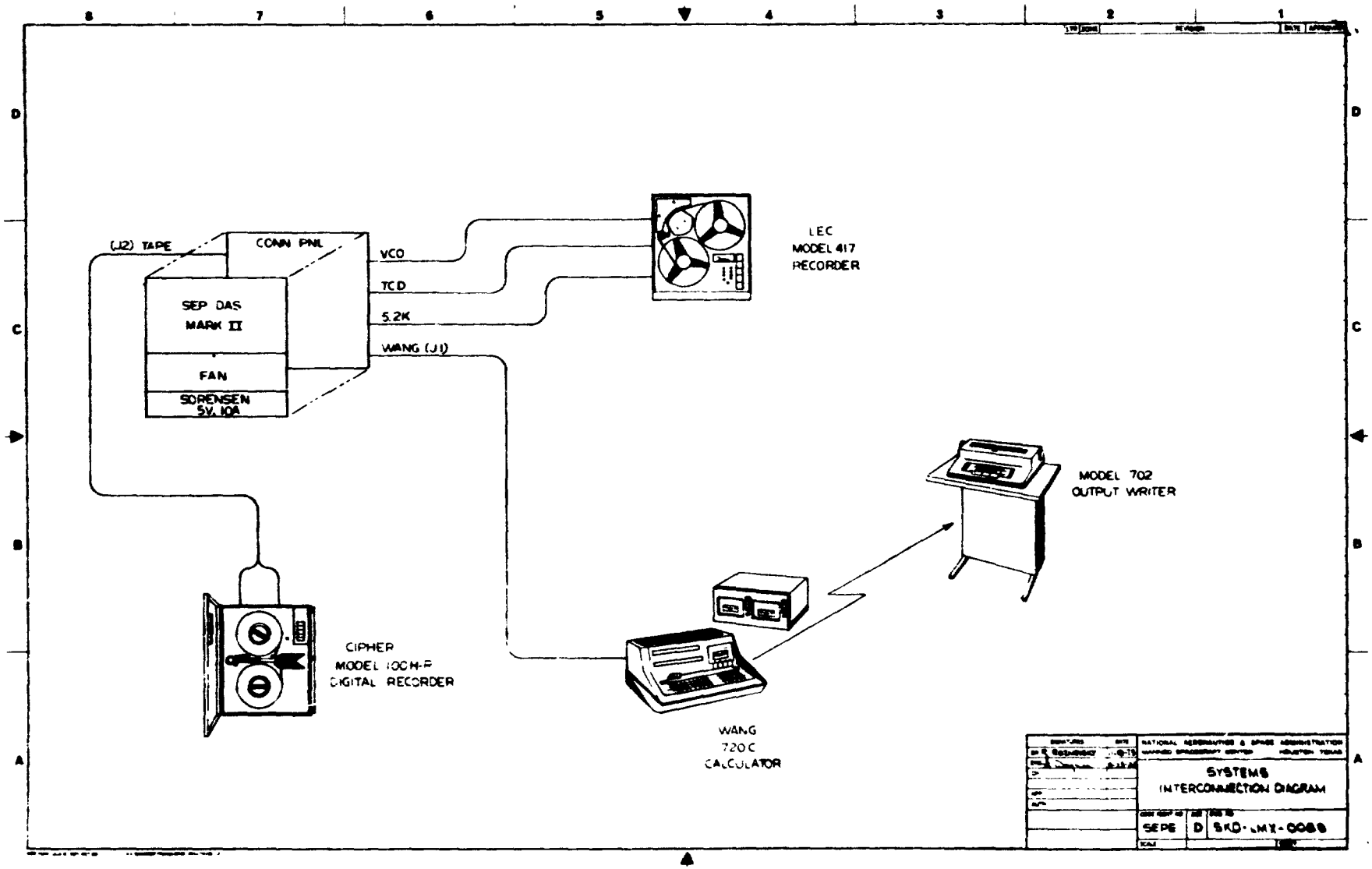
4.5.27 Six Decade Numeric Display, Drawing #SKD-LSX-0100

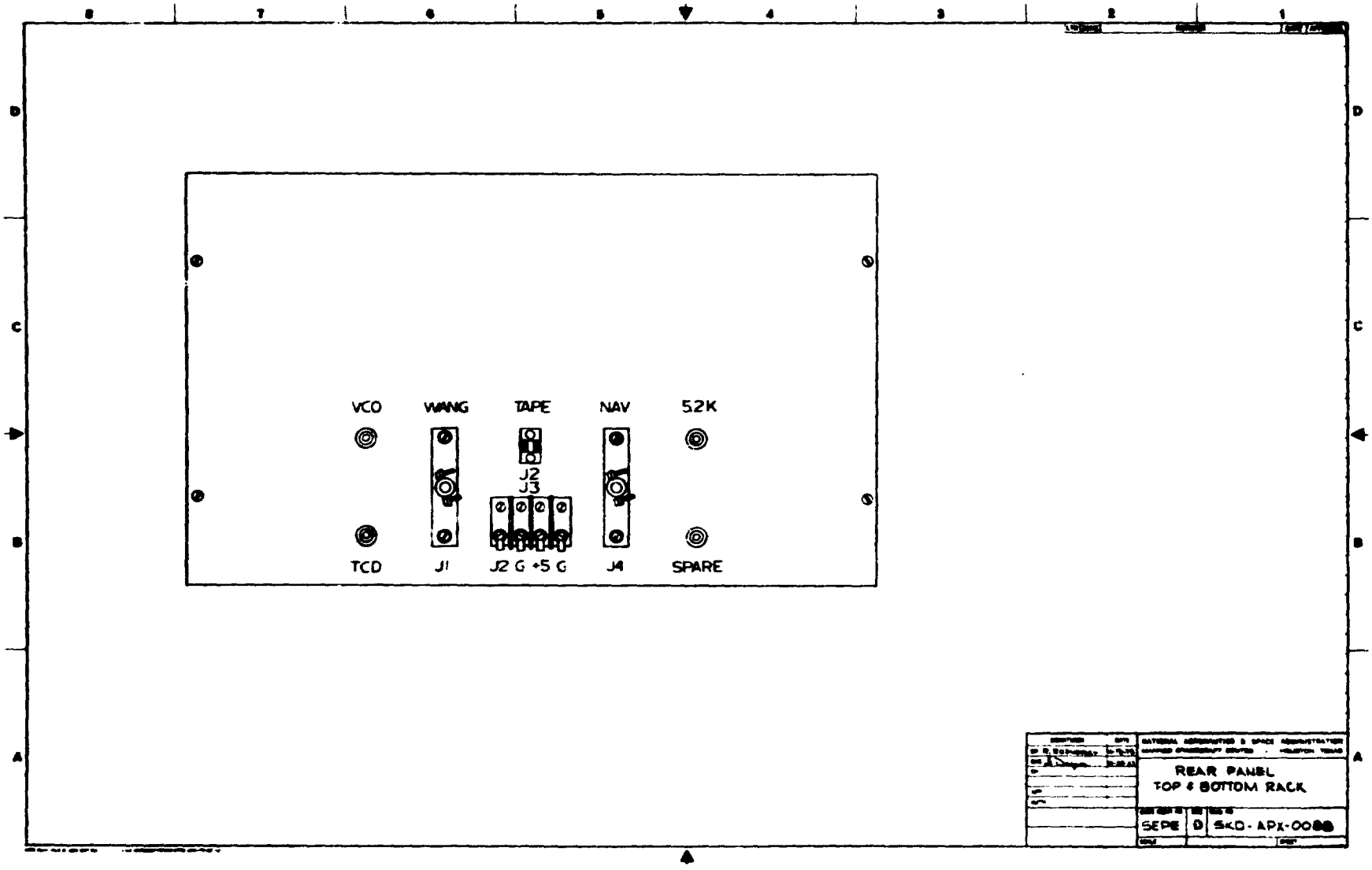
This pc card holds a maximum of six LED numeric display units. All seven segments are common to the output of the pc card and individual anode drive lines to each of the displays are provided by the input to the pc card. This

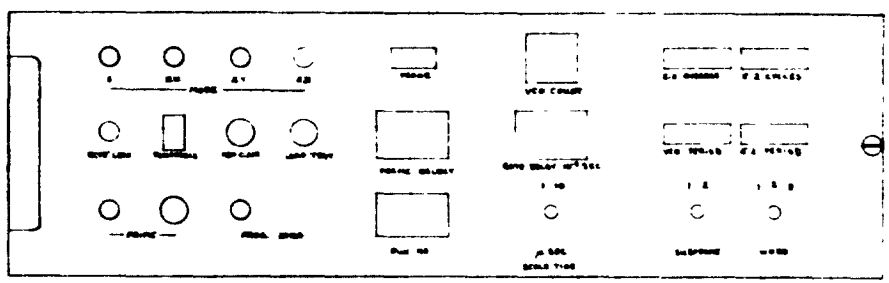
pc card is used in conjunction with the LED driver/buffer pc card, drawing #SKD-LSX-0075.

APPENDIX A

MAINTENANCE – SCHEMATIC DIAGRAMS

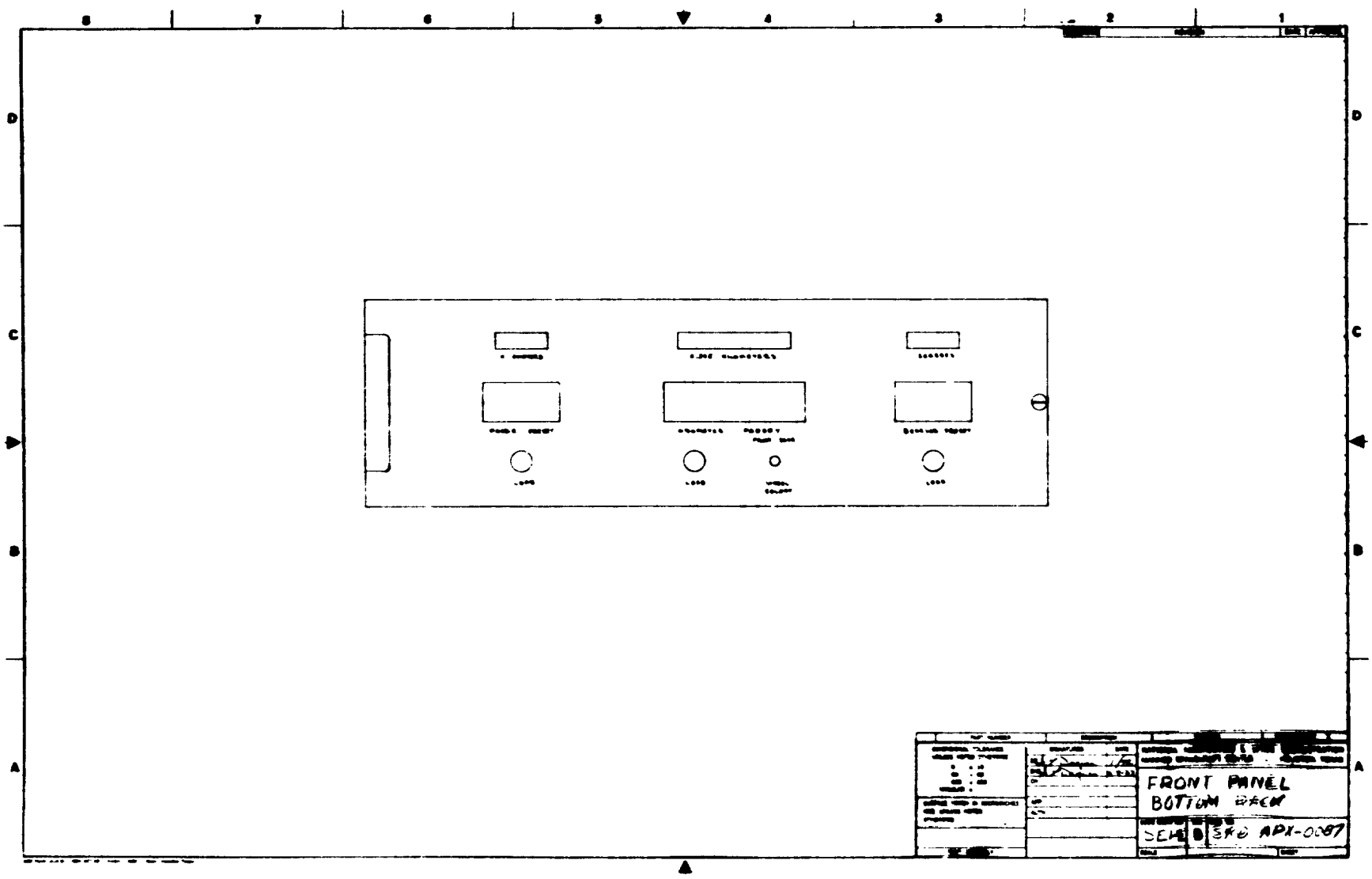

(J2) TAPE
CONN PNL
SEP DAS
MARK II
FAN
SORENSEN
5V, 10A
VCO
TCD
5.2K
WANG (J1)
LEC
MODEL 417
RECORDER
MODEL 702
OUTPUT WRITER
CIPHER
MODEL 10CM-F
DIGITAL RECORDER
WANG
720C
CALCULATOR
SYSTEMS
INTERCONNECTION DIAGRAM
SEPE
D
SKD-MX-0088

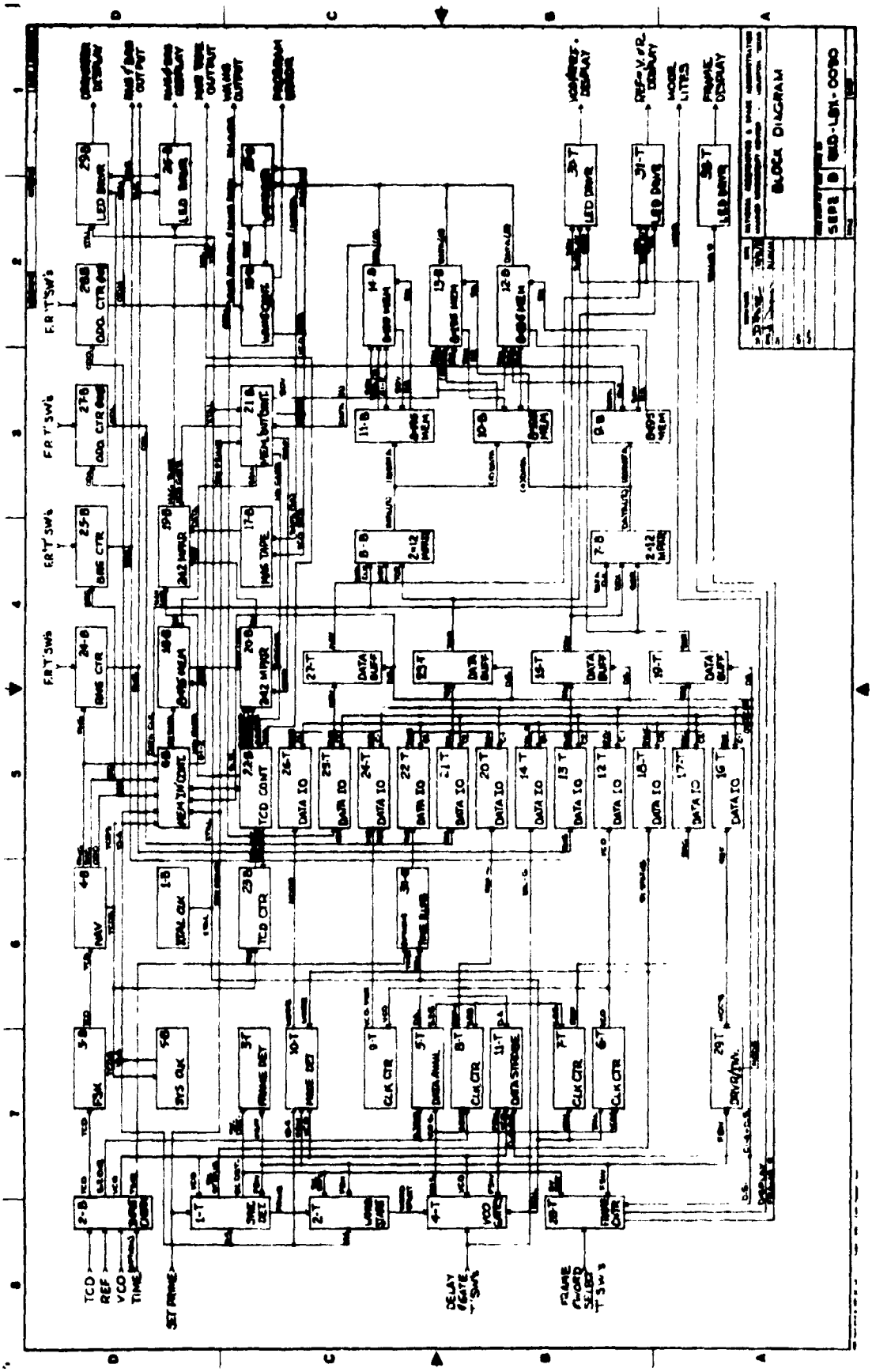

VCO
WANG
TAPE
NAV
5.2K
J2
J3
TCD
J1
J2 G +5 G
J4
SPARE
REAR PANEL
TOP & BOTTOM RACK
SEPE
D
SKD-APX-0088



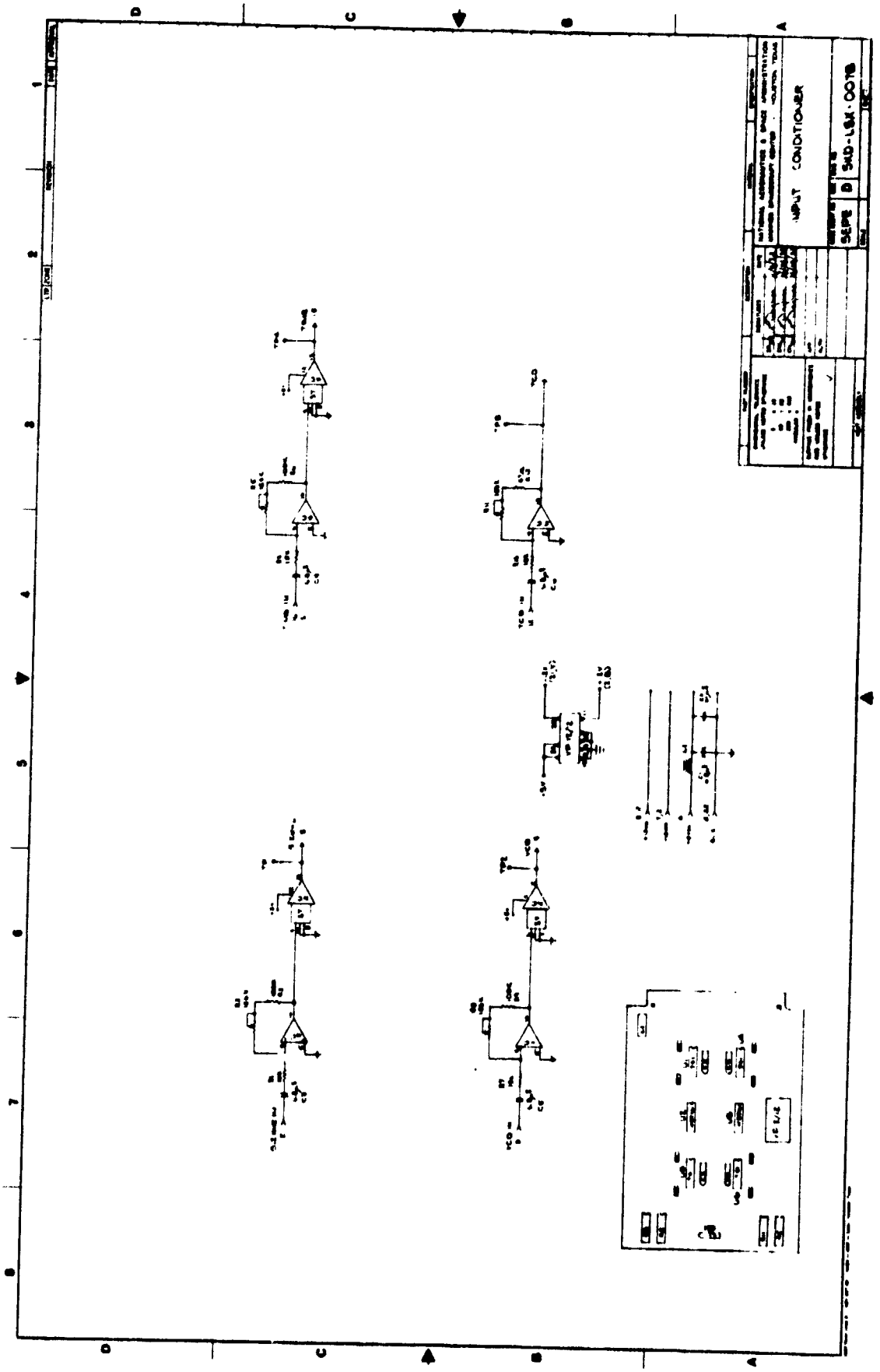
FRONT PANEL
TOP RACK

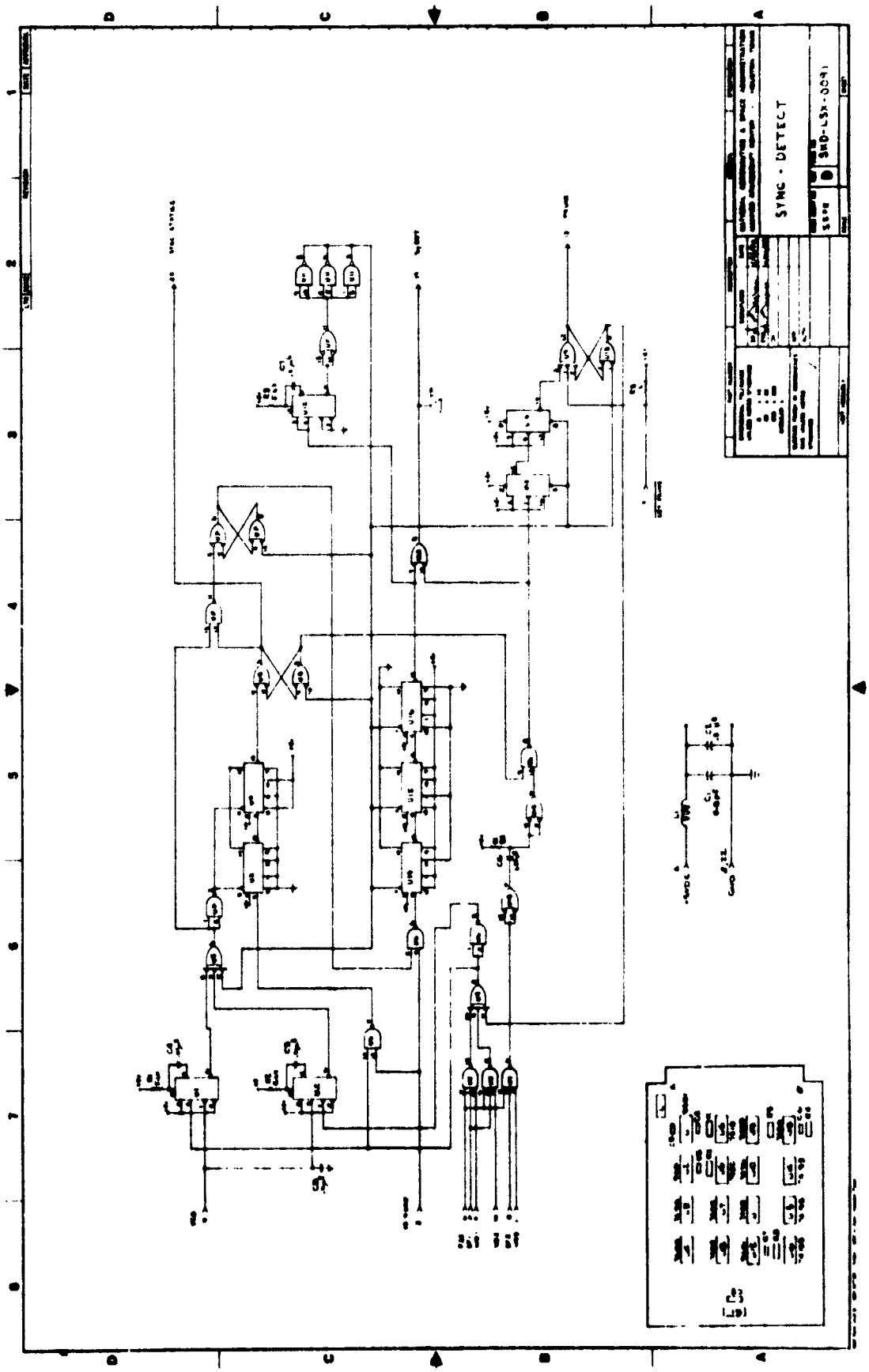
SCALE D CAD ADX 0086

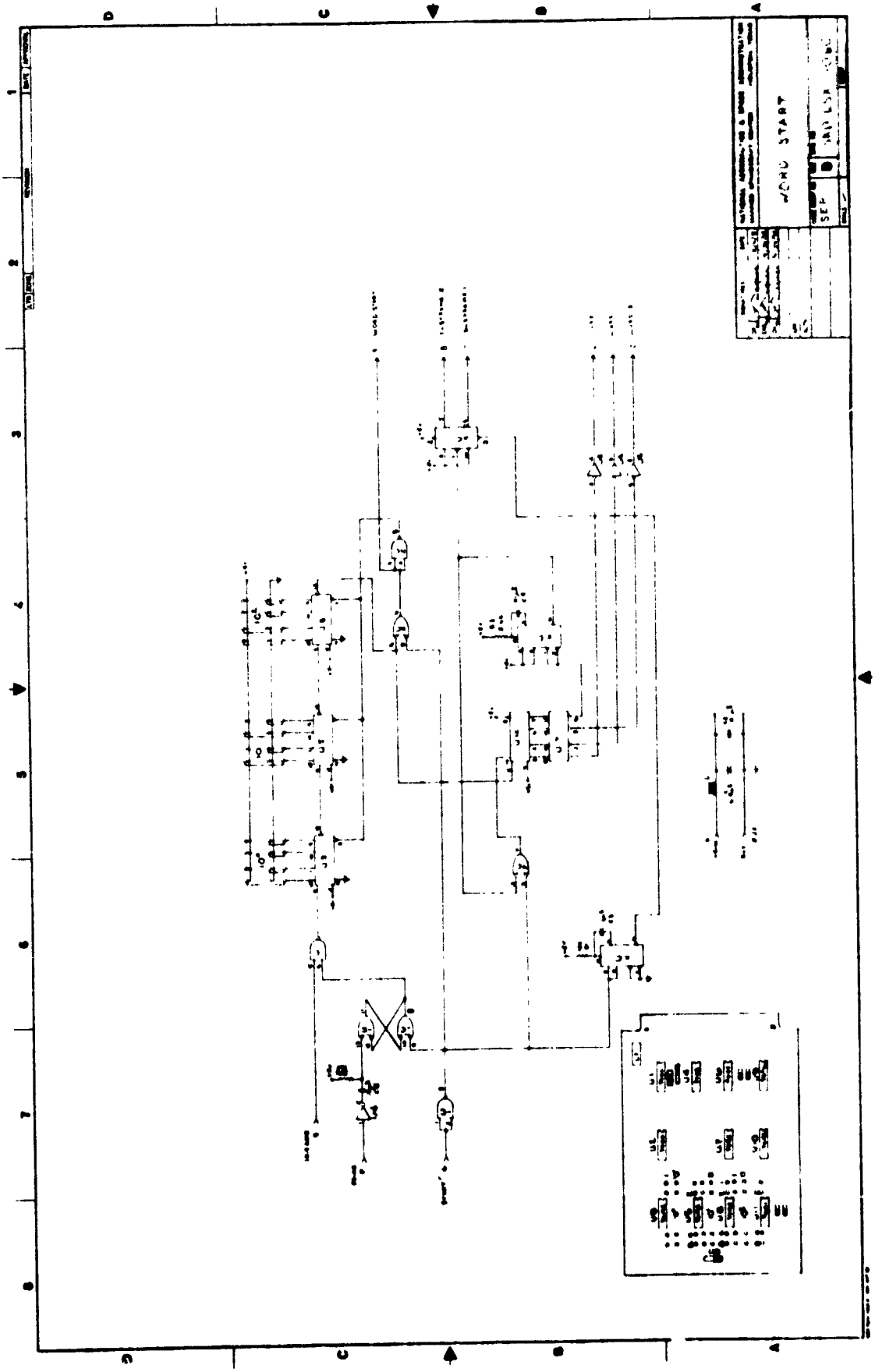

FRONT PANEL
BOTTOM BACK
SCALE
SIZE
D
SHEET
APX-0087

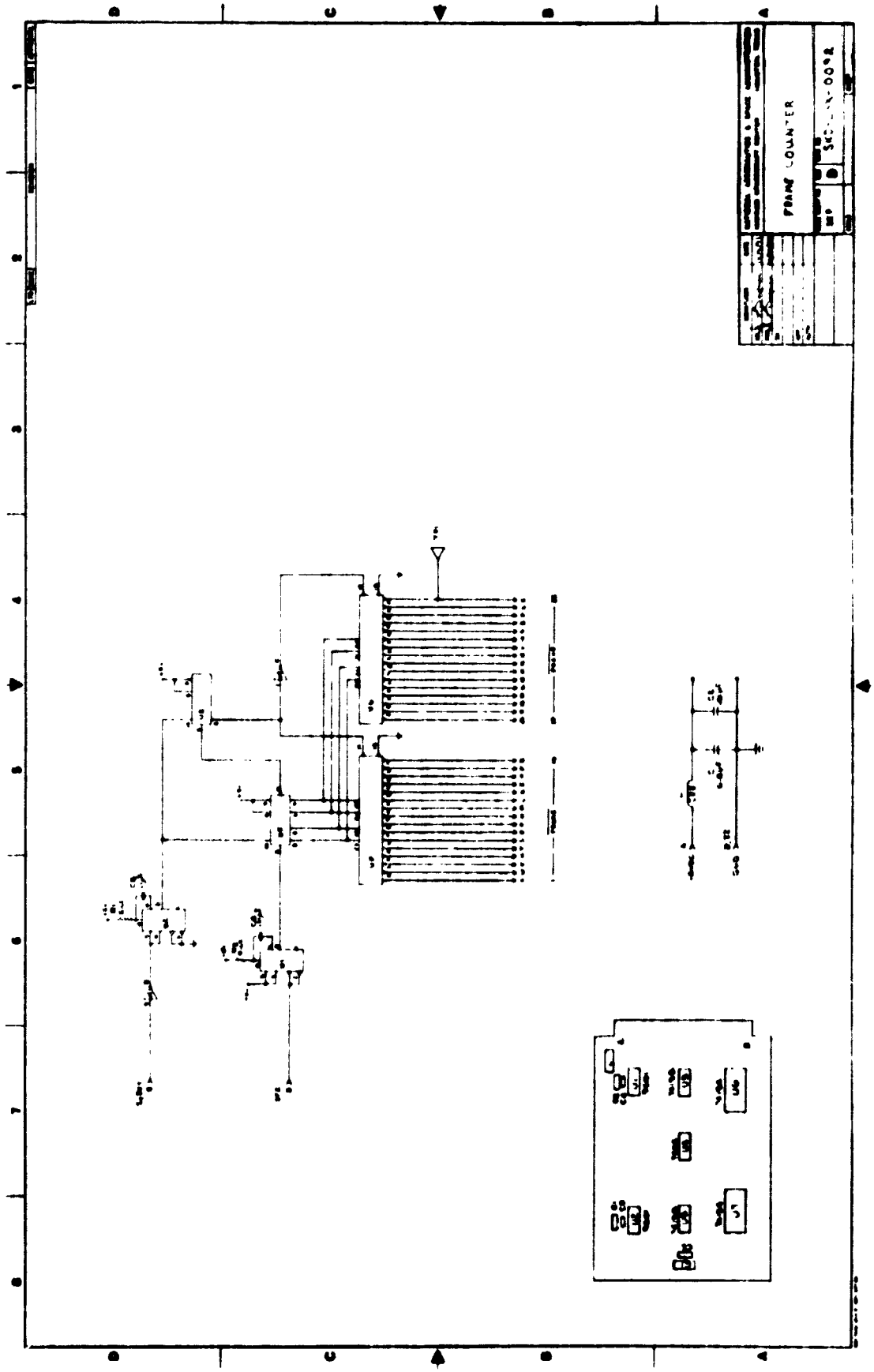


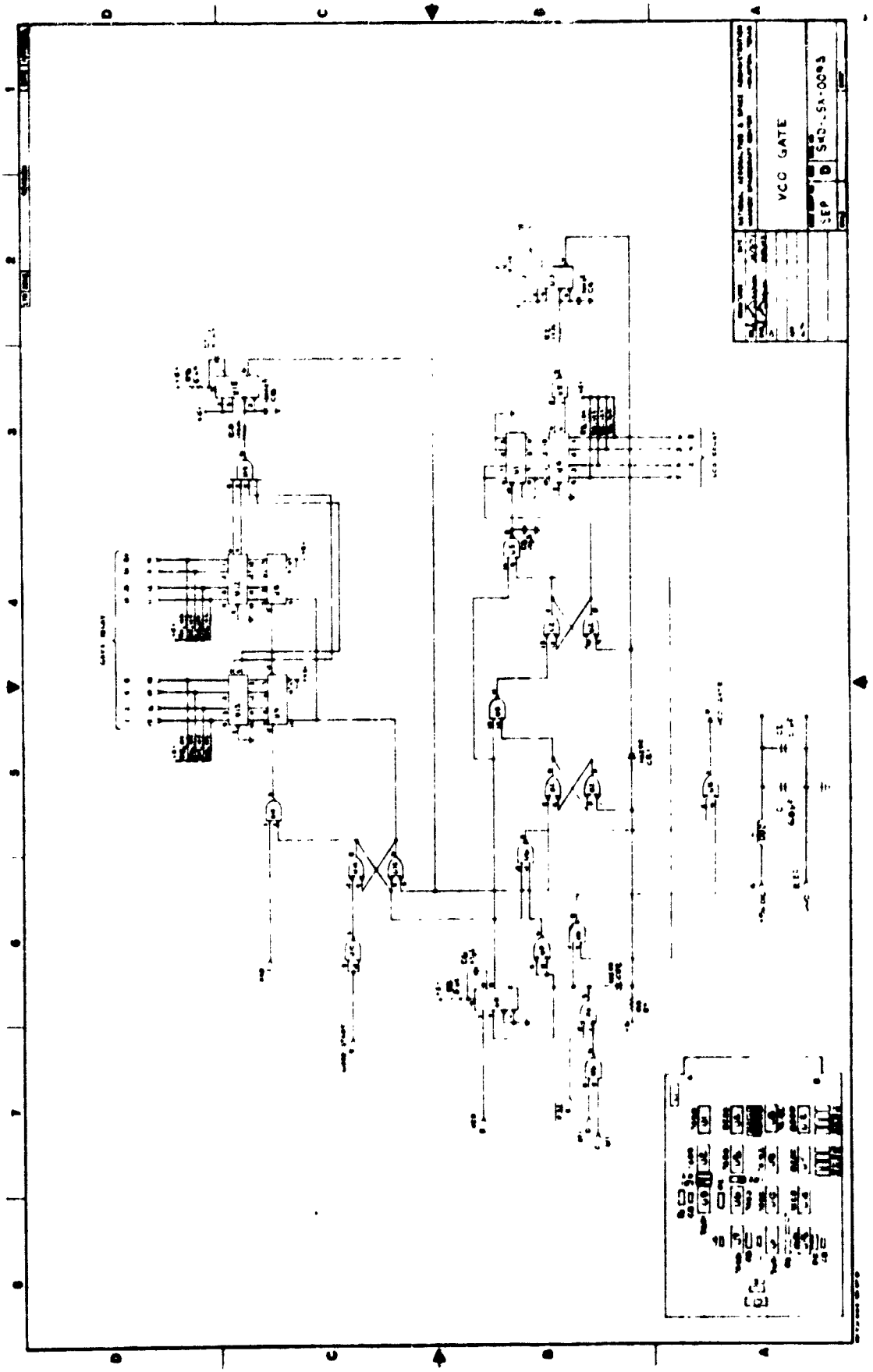
PRECEDING PAGE BLANK NOT FILMED

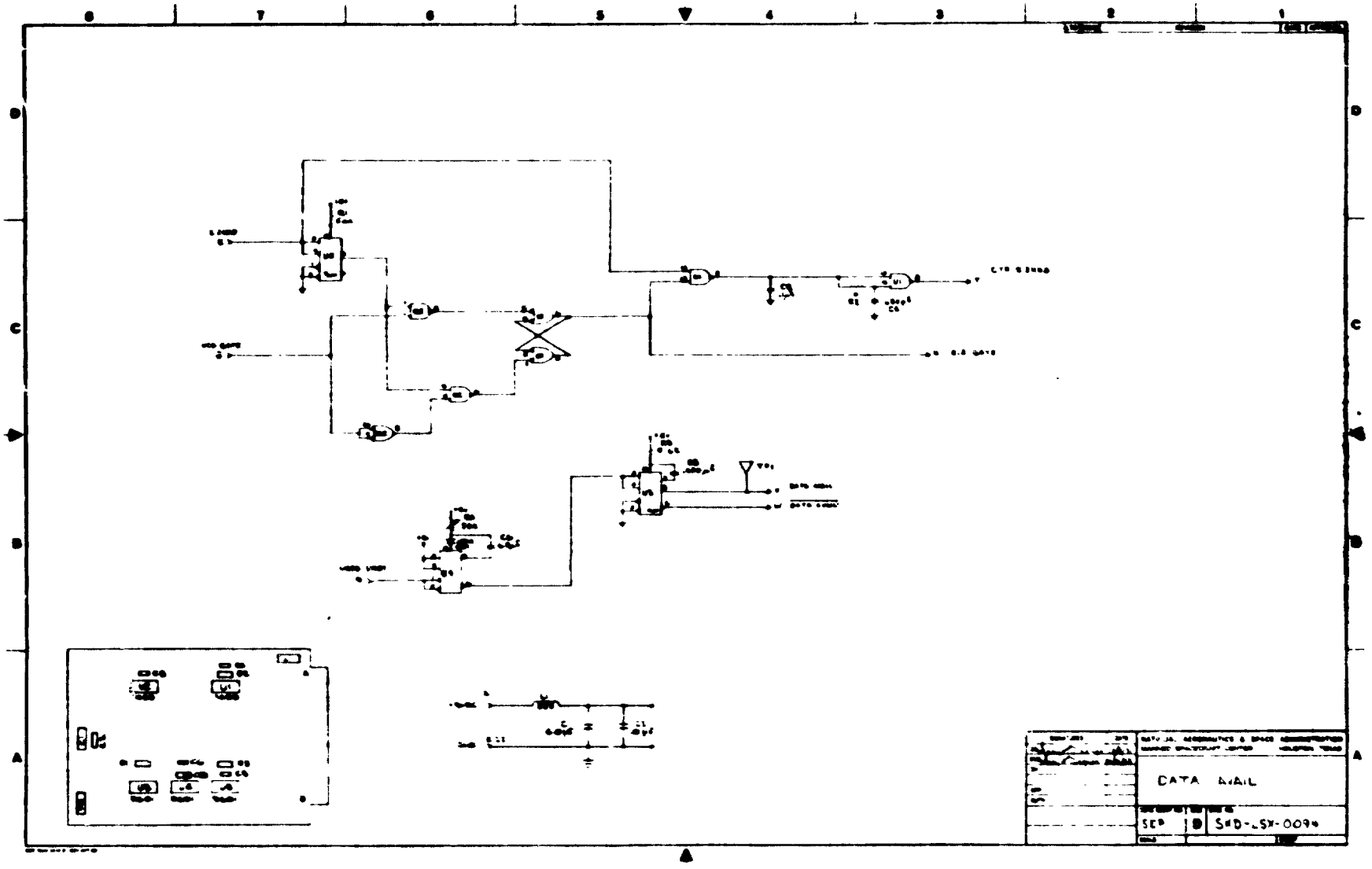

INPUT CONDITIONER

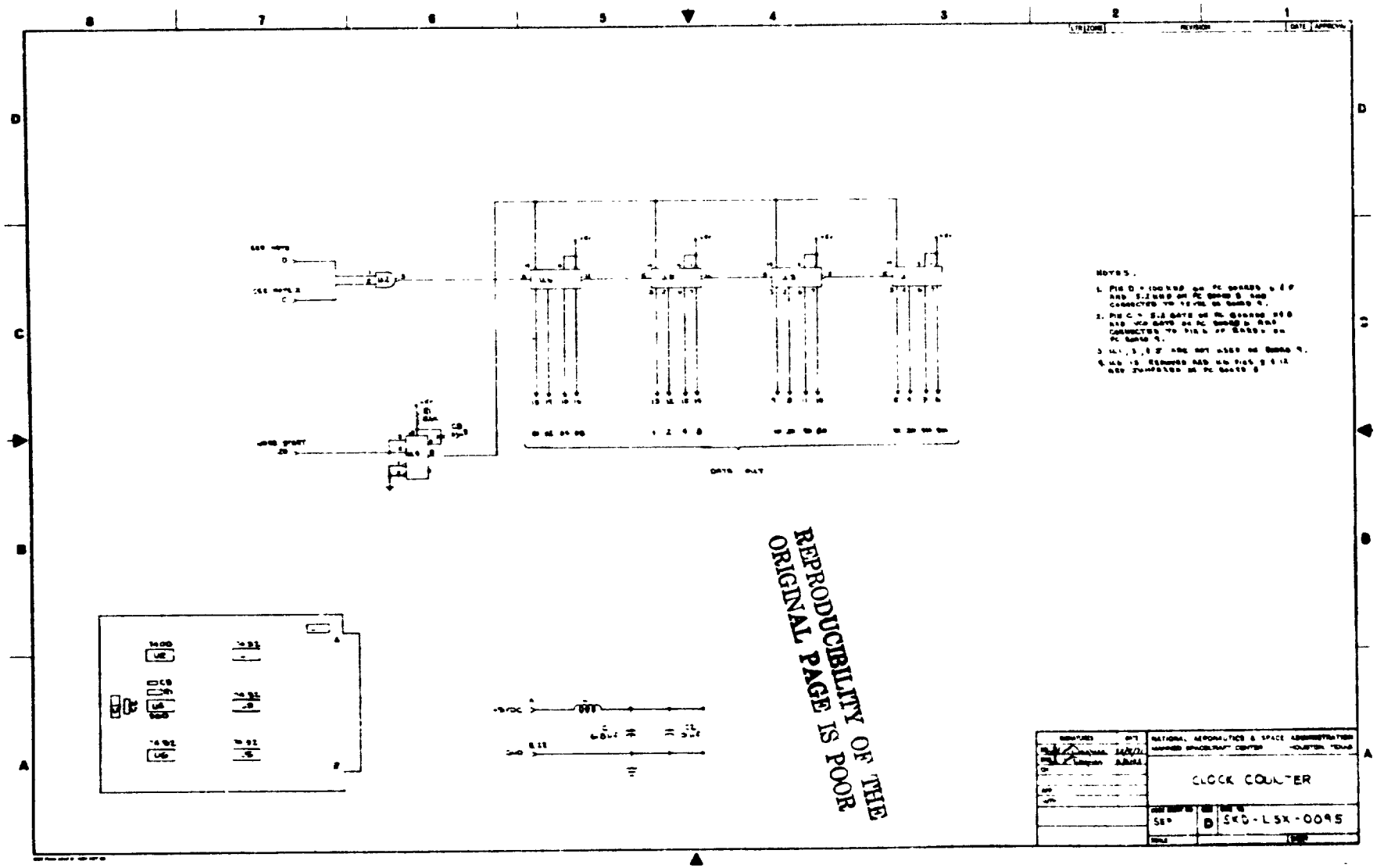

SYNC - DETECT

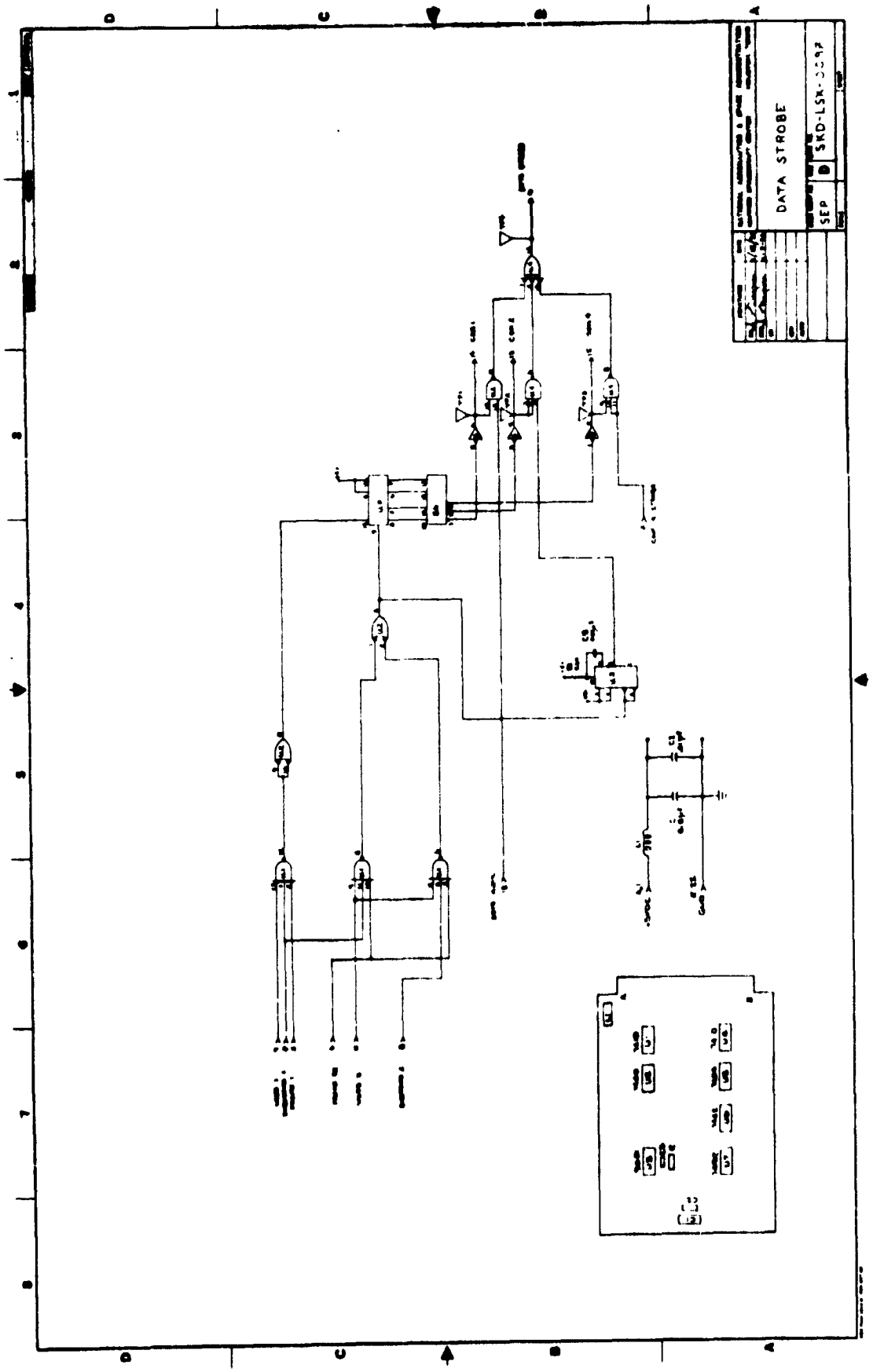


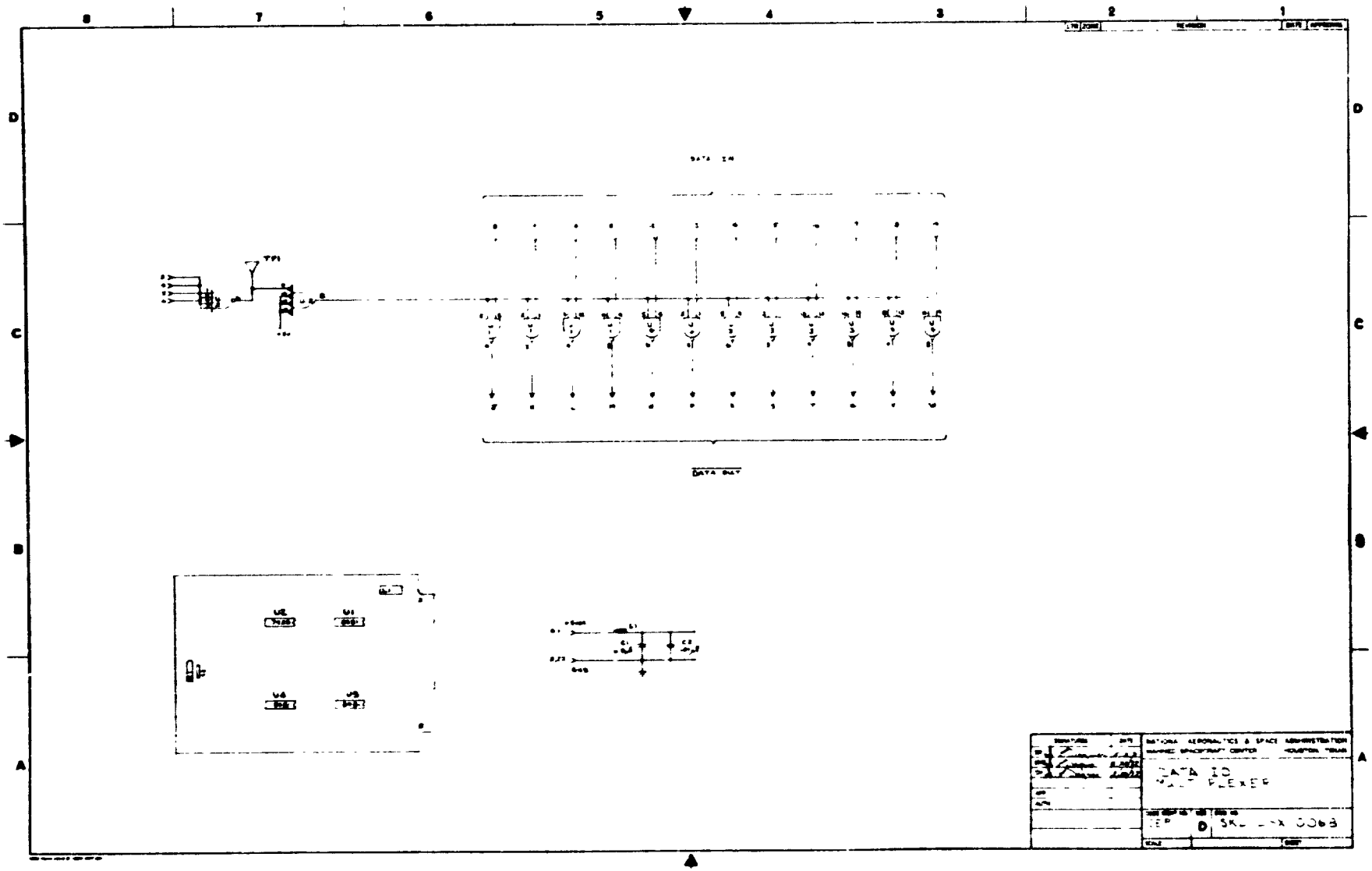

POINT COUNTER

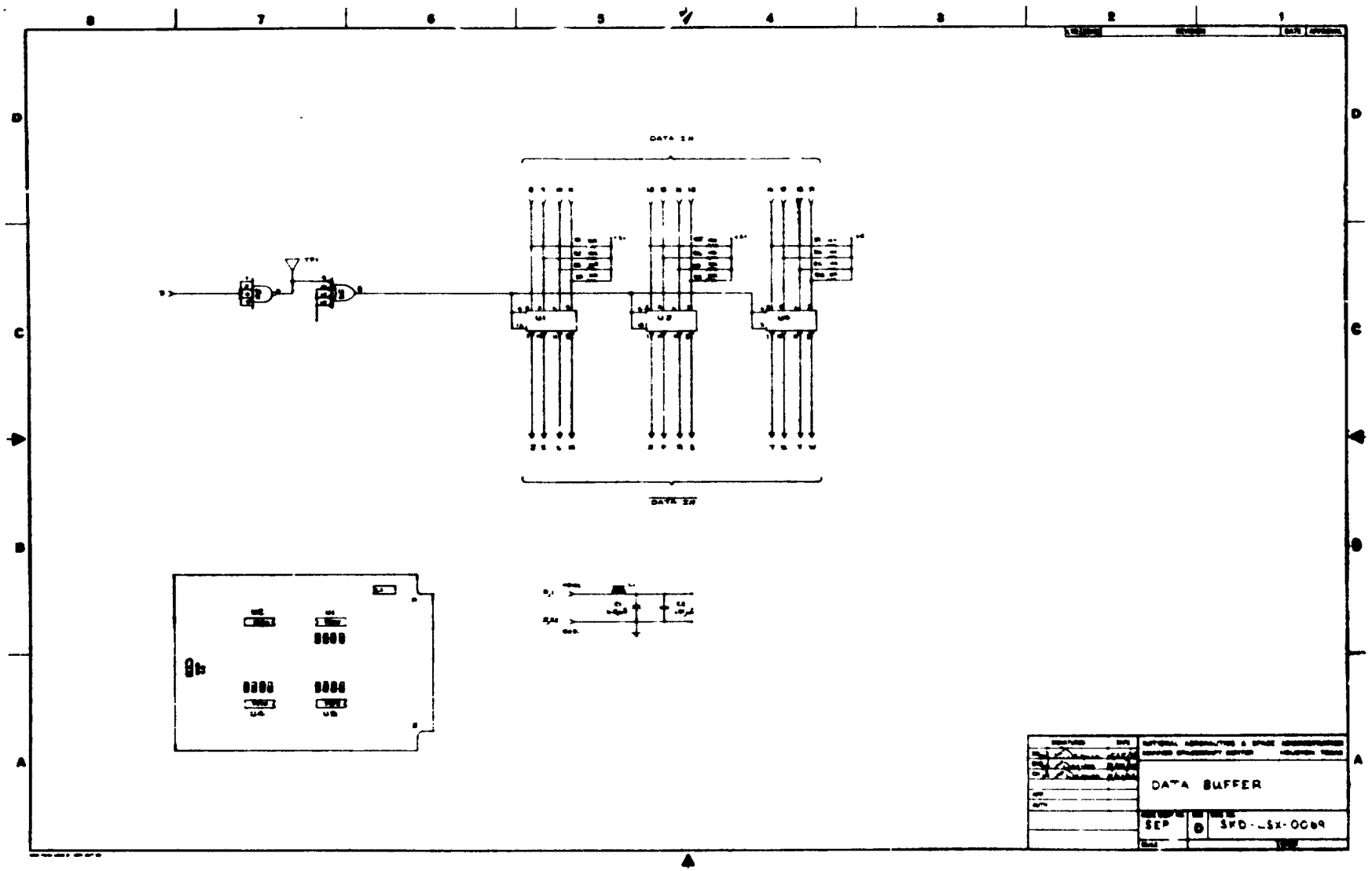

VCO GATE

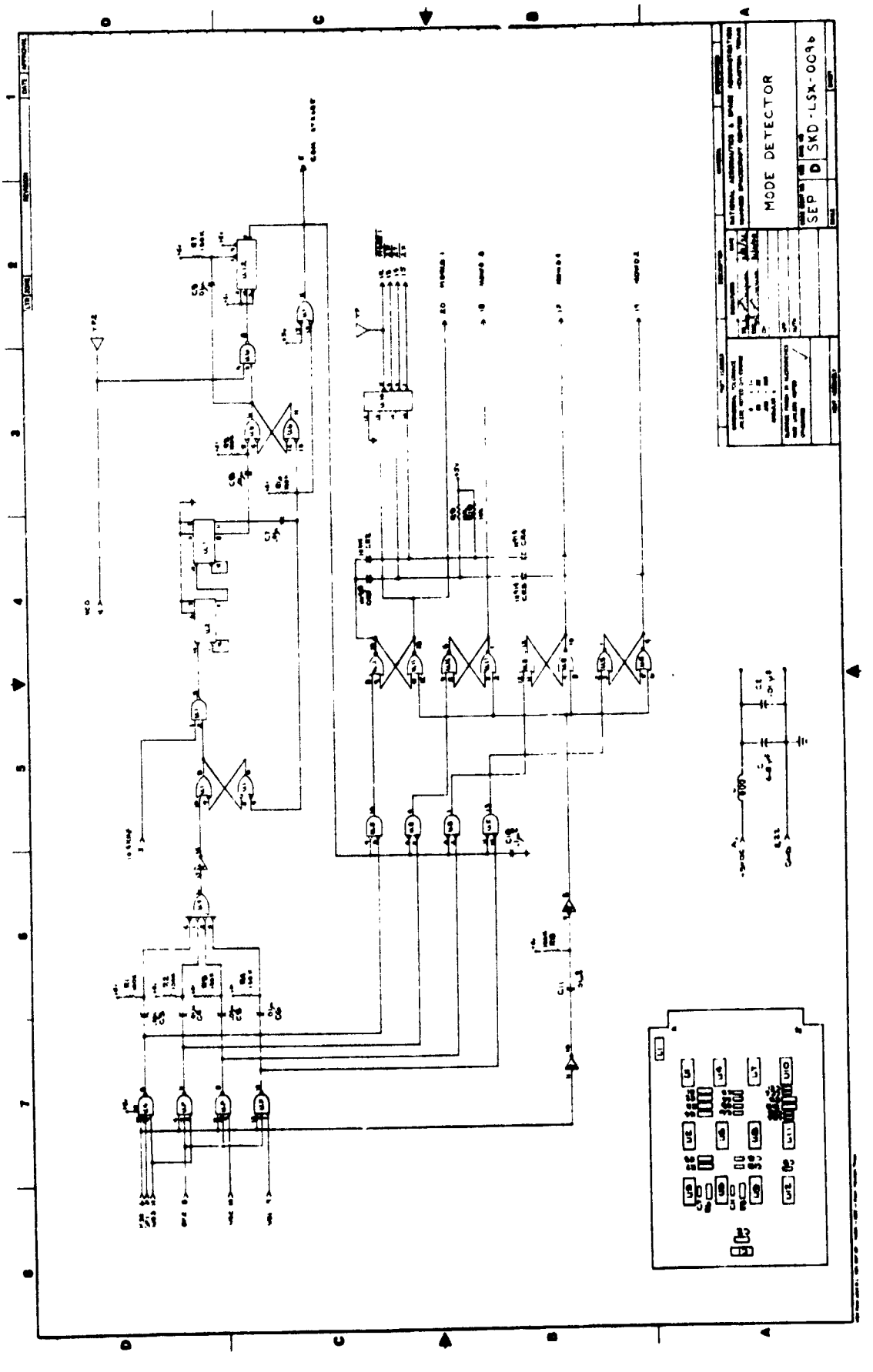

DATA AVAIL

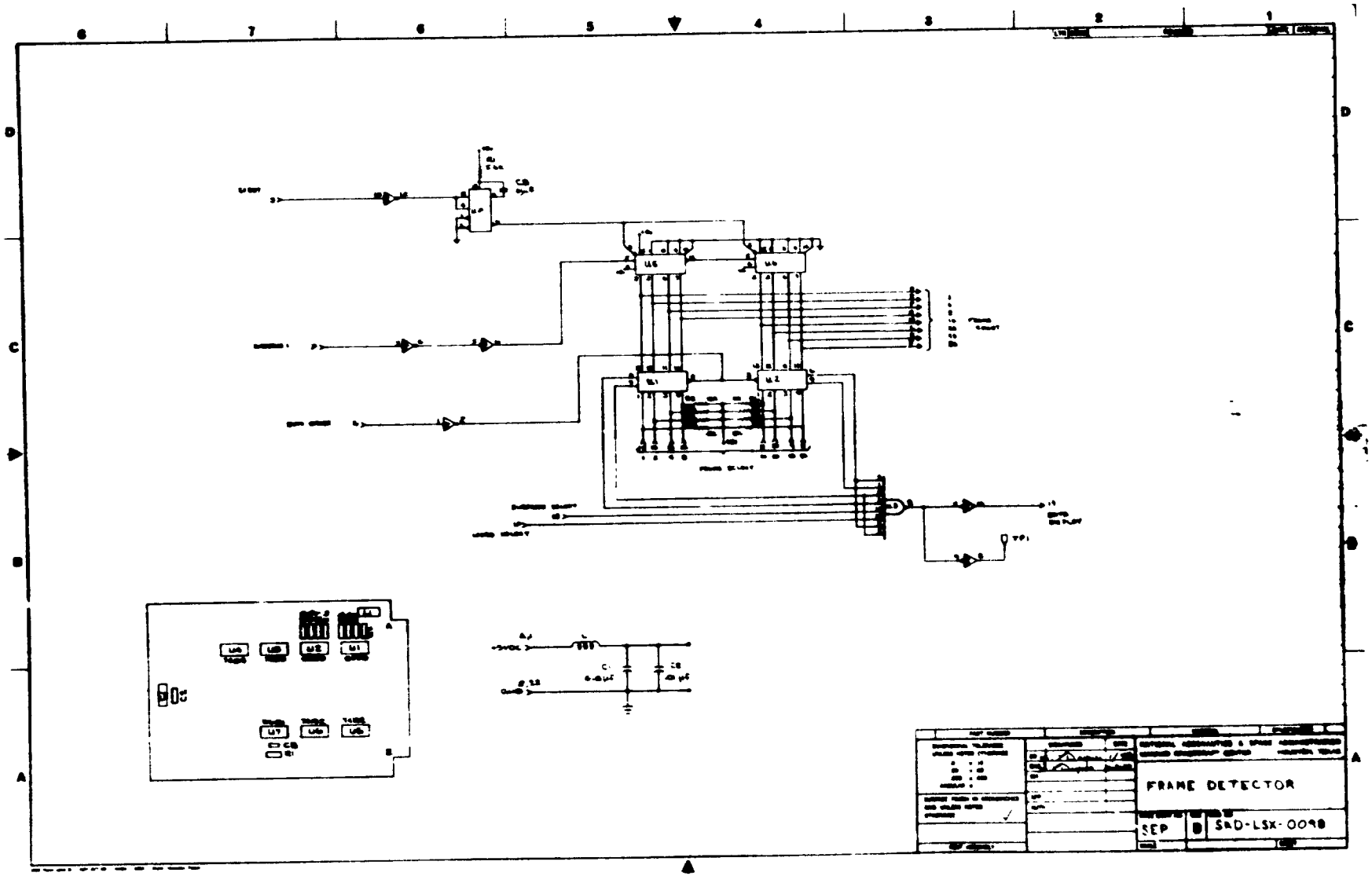

CLOCK COUNTER
SKD-LSX-0095
D
REPRODUCIBILITY OF THE ORIGINAL PAGE IS POOR

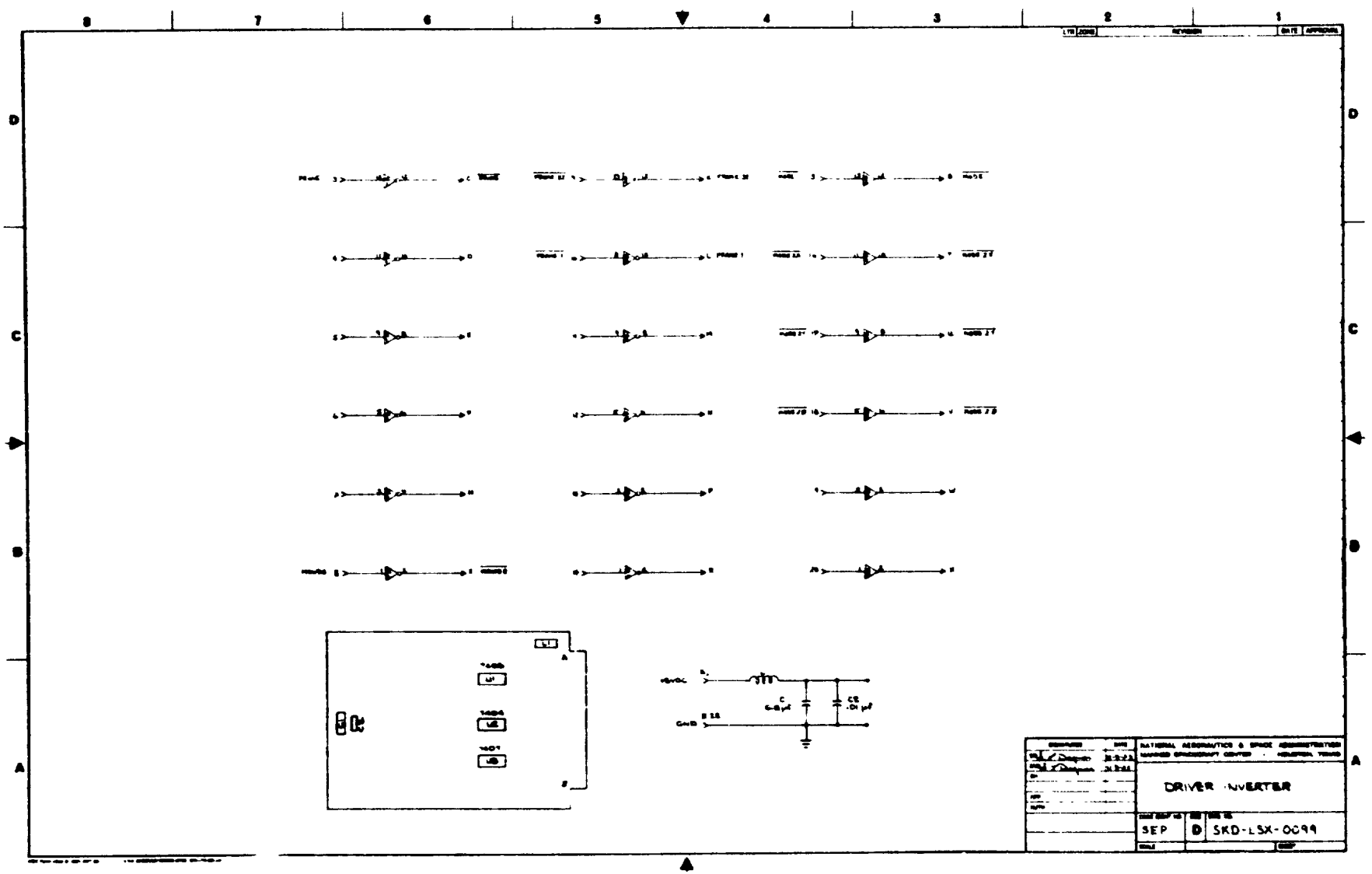

DATA STROBE
SEP
D

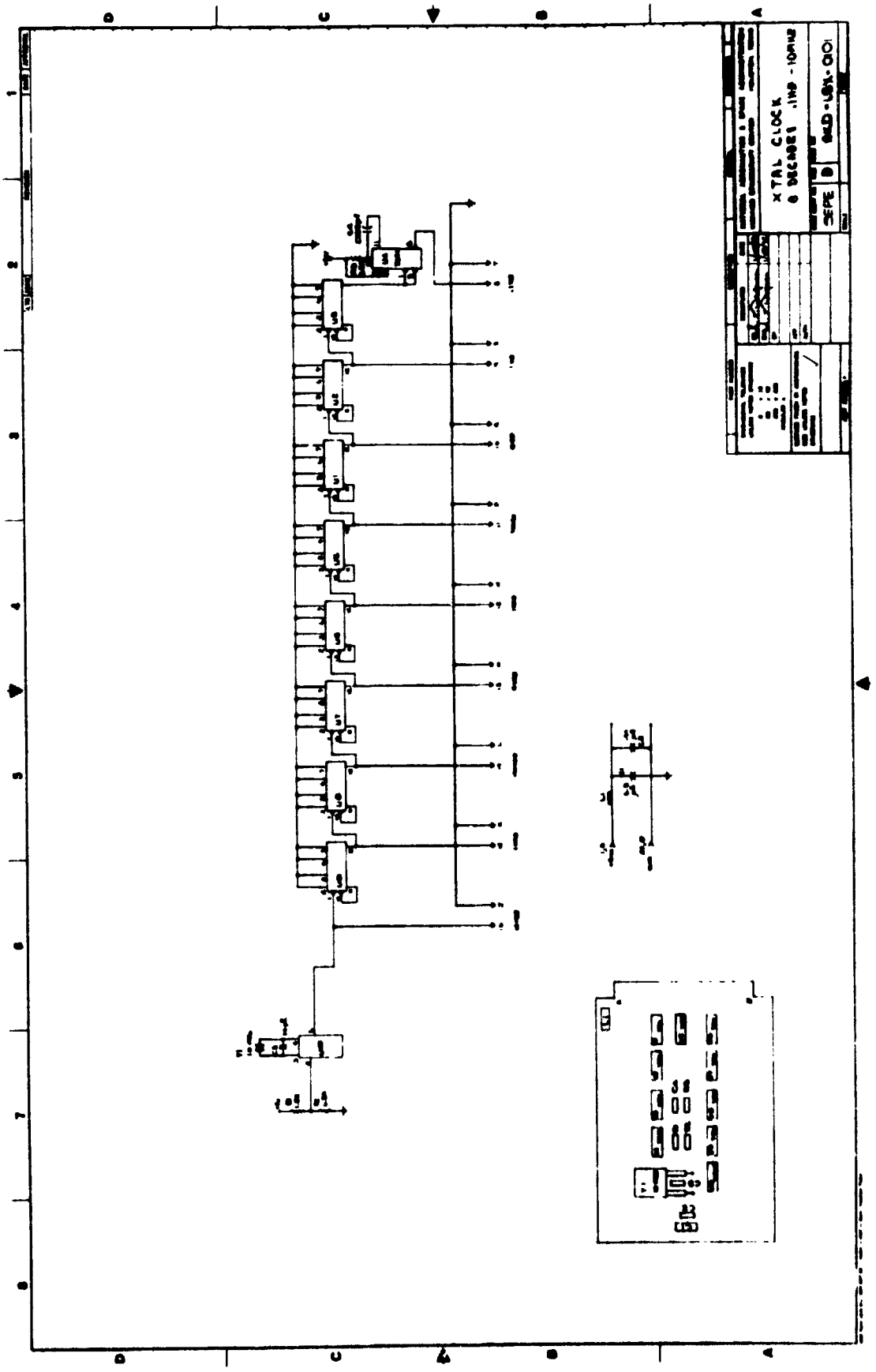

8
7
6
5
4
3
2
1
D
C
B
A
DATA ID
MULTIPLEXER
D

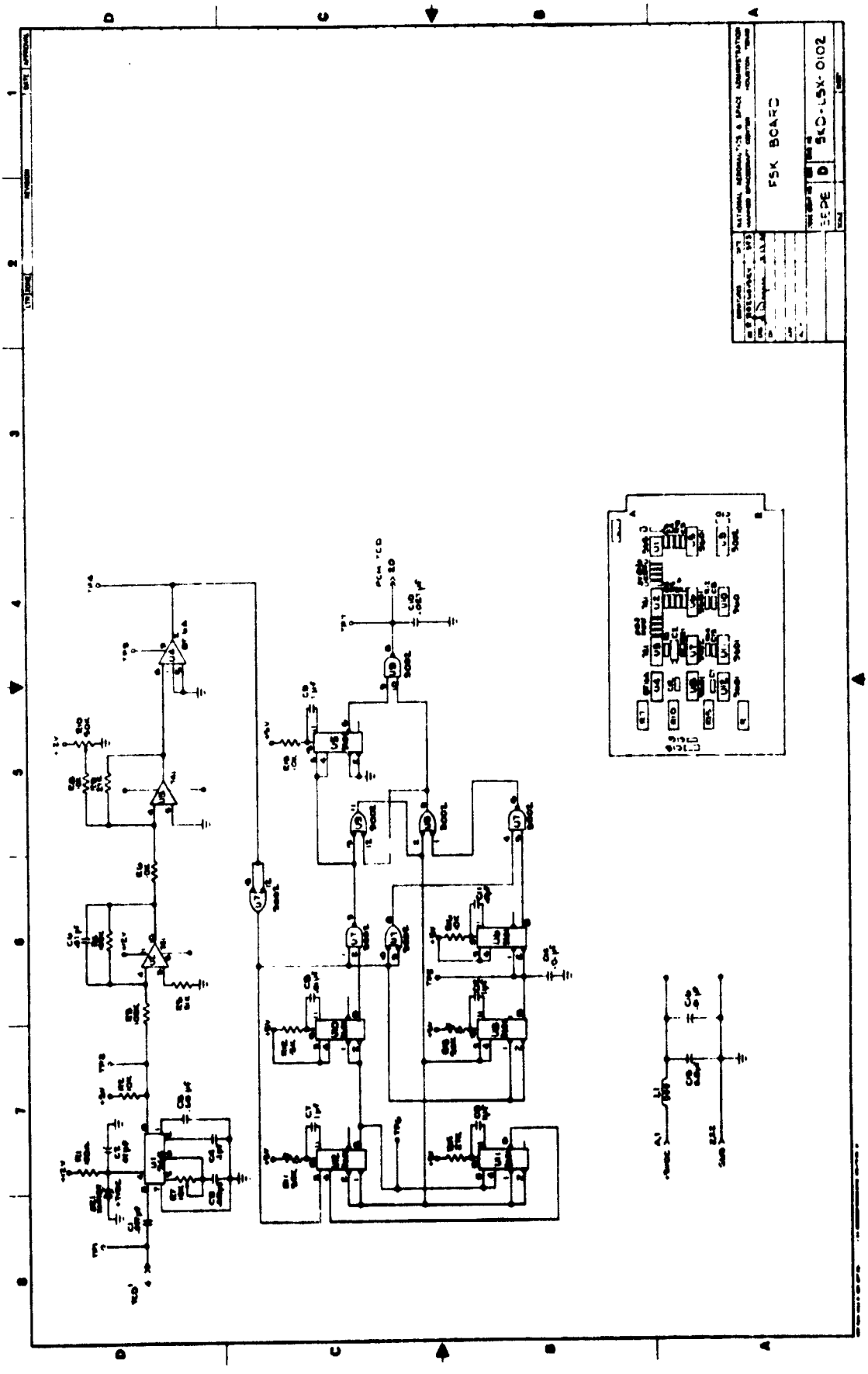

DATA BUFFER
SEP
D
SYD-LSX-0069

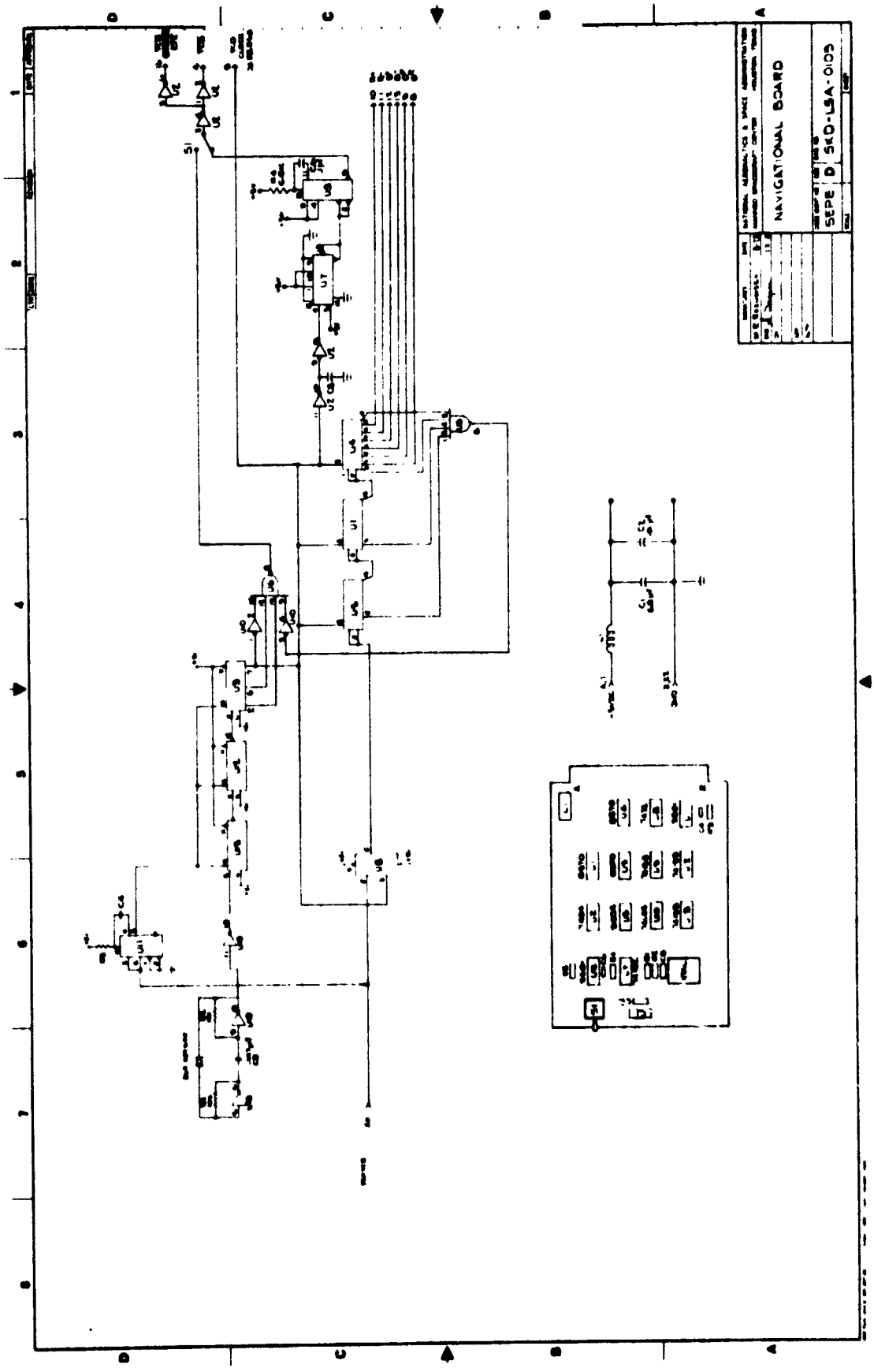

MODE DETECTOR
SEP
D
SKD-LSX-0096

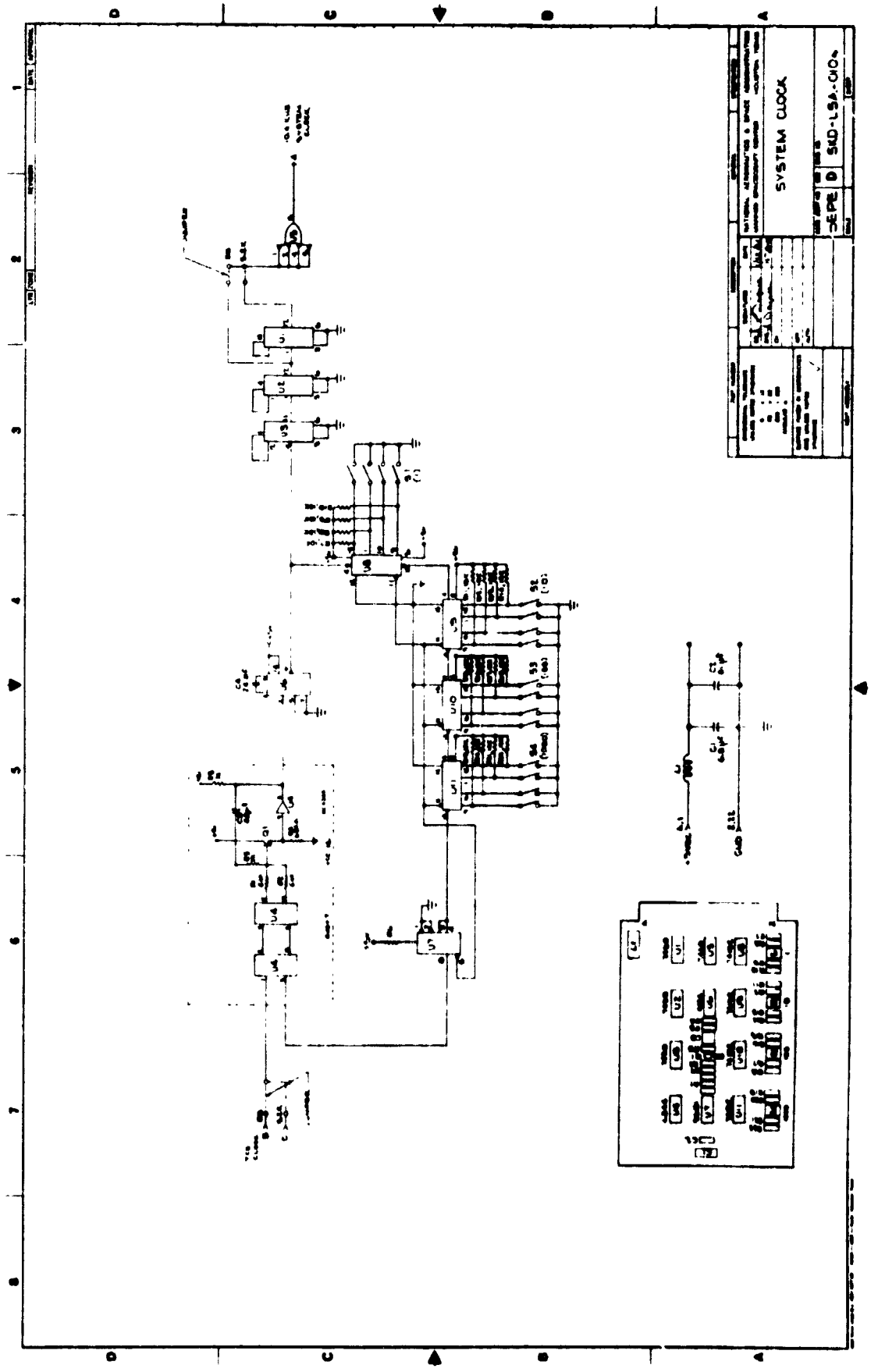

FRAME DETECTOR
SEP
B
SAD-LSX-0098

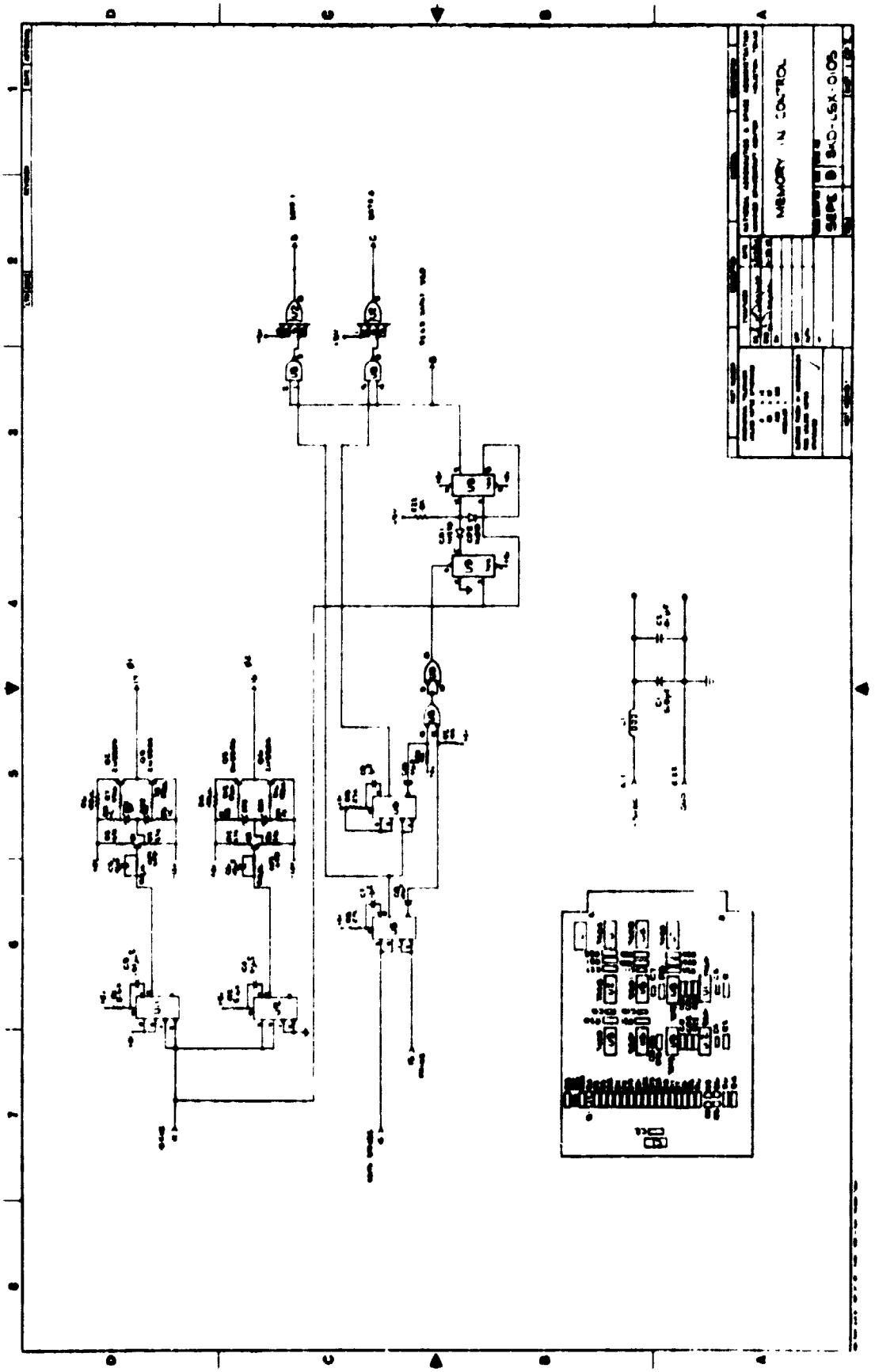

8
7
6
5
4
3
2
1
D
C
B
A
DRIVER INVERTER
SEP
D
SKD-LSX-0099

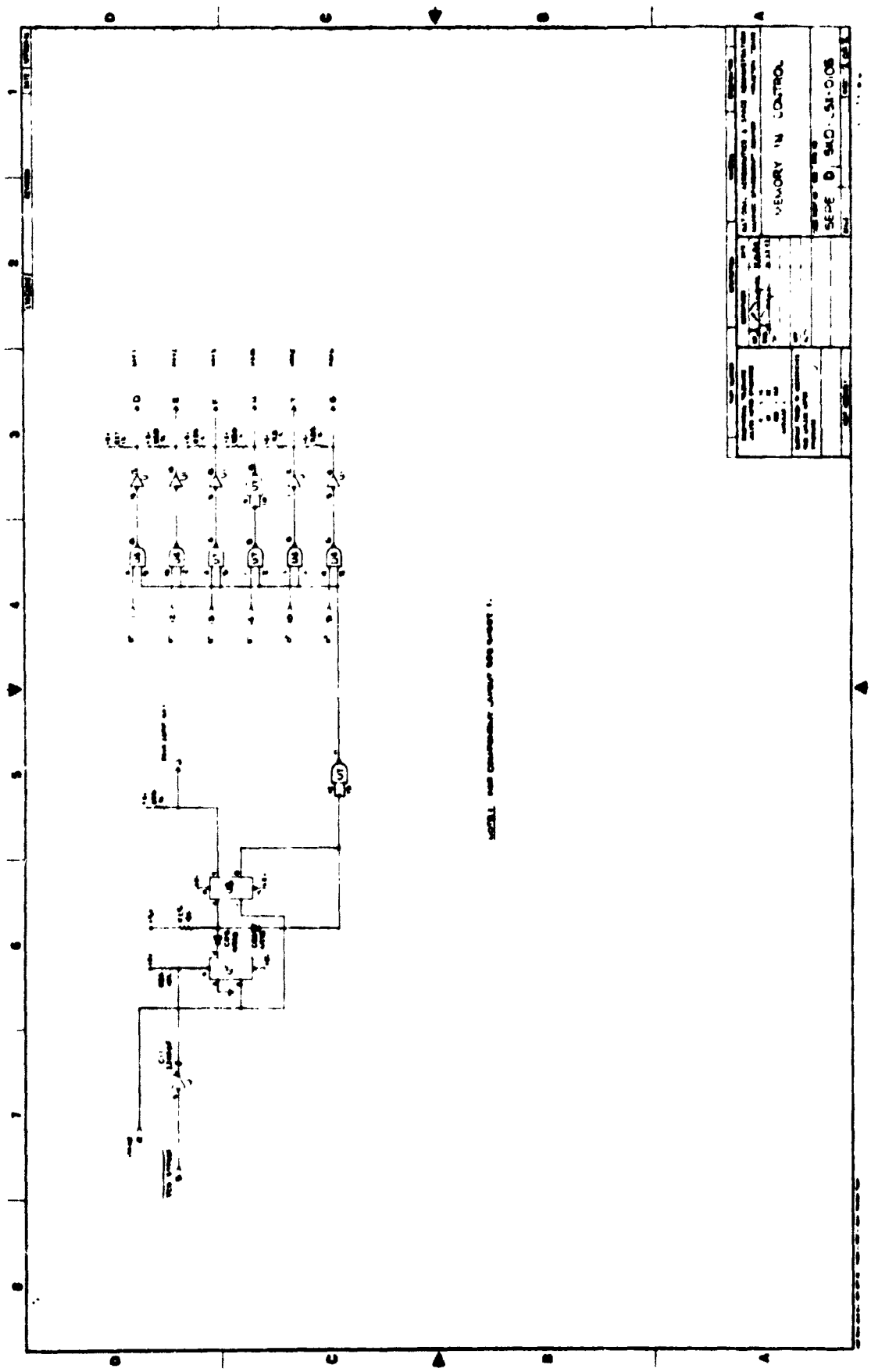

XTAL CLOCK
SIZE
D

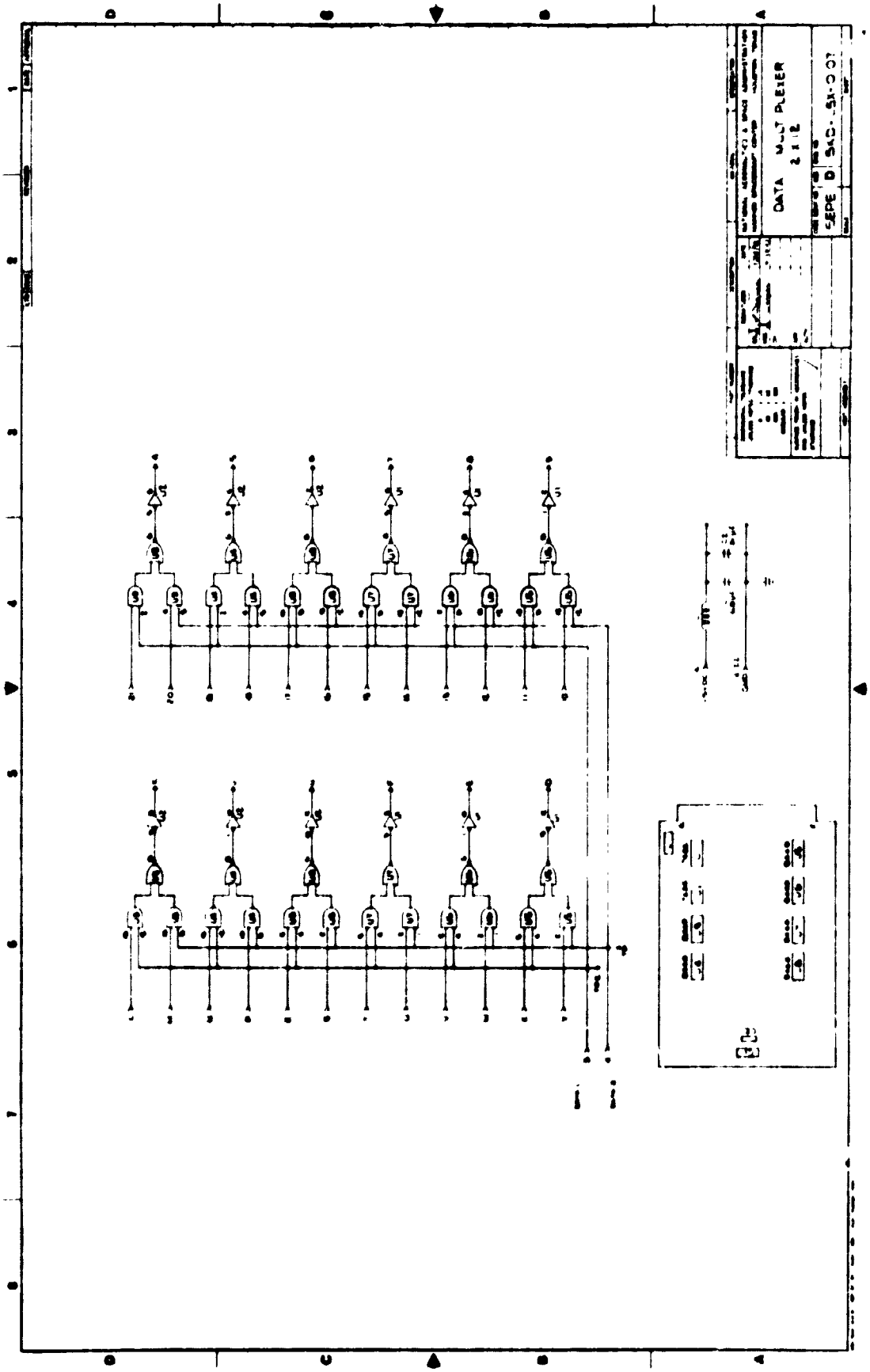

FSK BOARD
SIZE D
SKD-LSX-0102

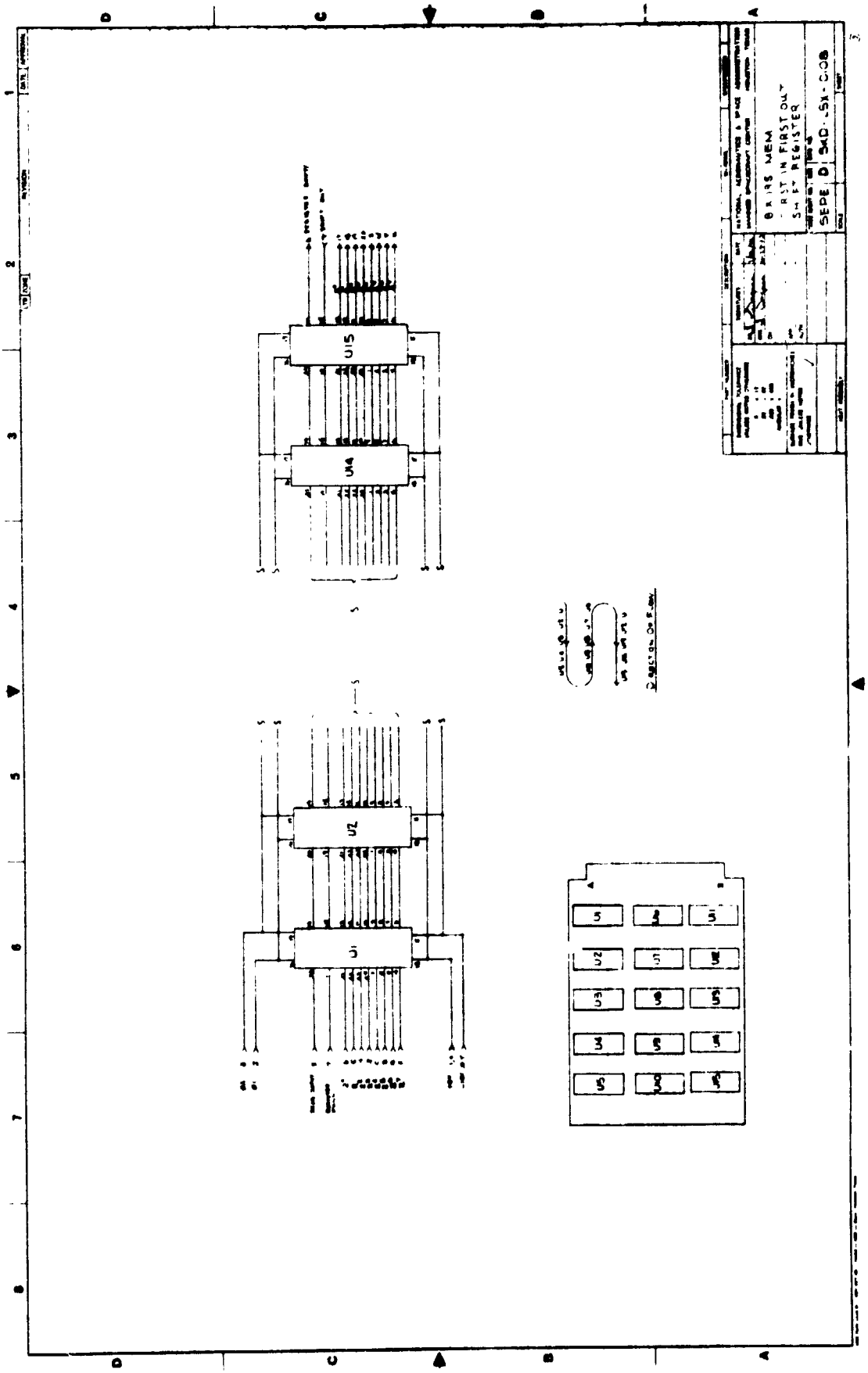

NAVIGATIONAL BOARD
SEPE D SKD-LSA-0103

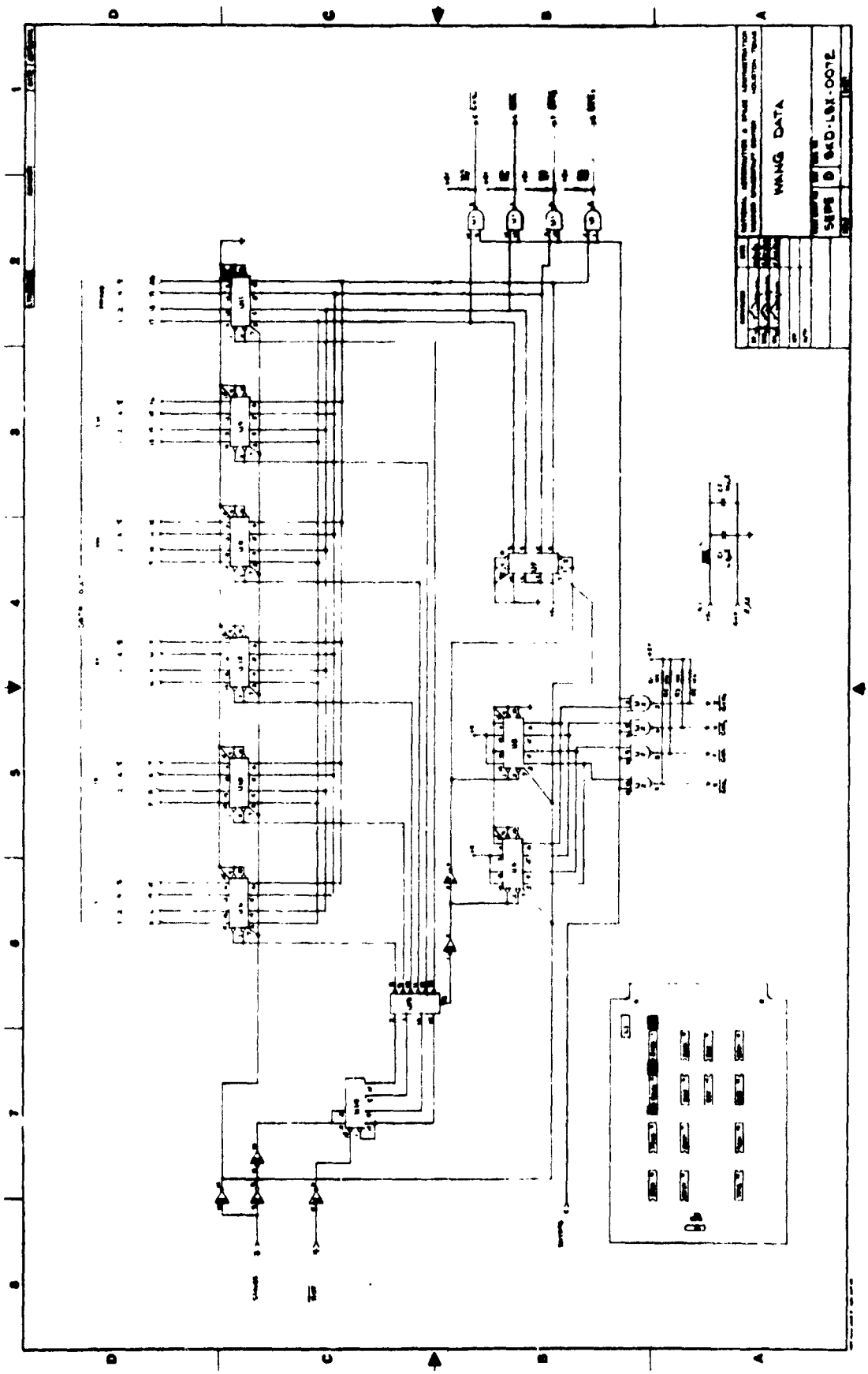

SYSTEM CLOCK
SKD-LSA-004

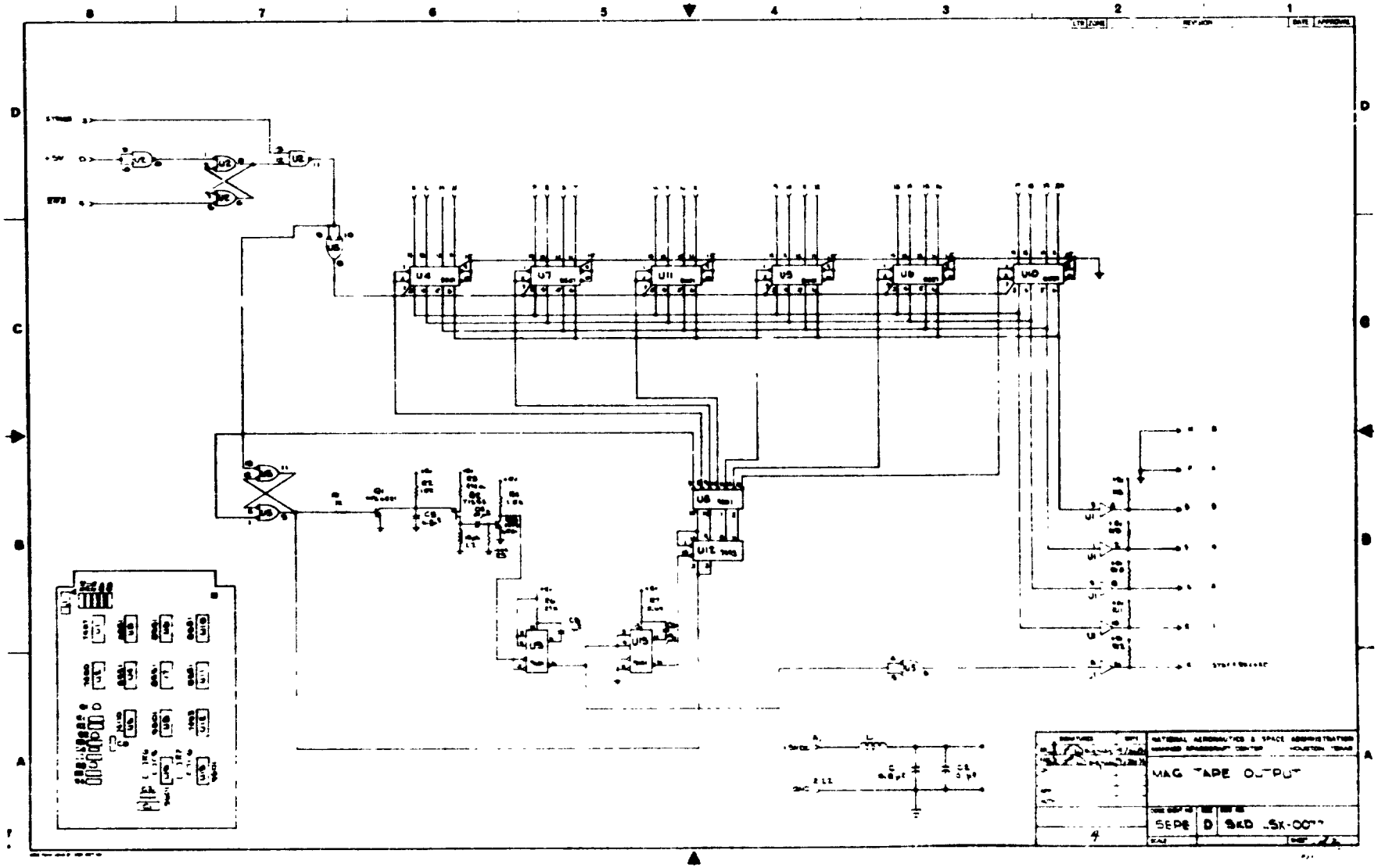

MEMORY CONTROL

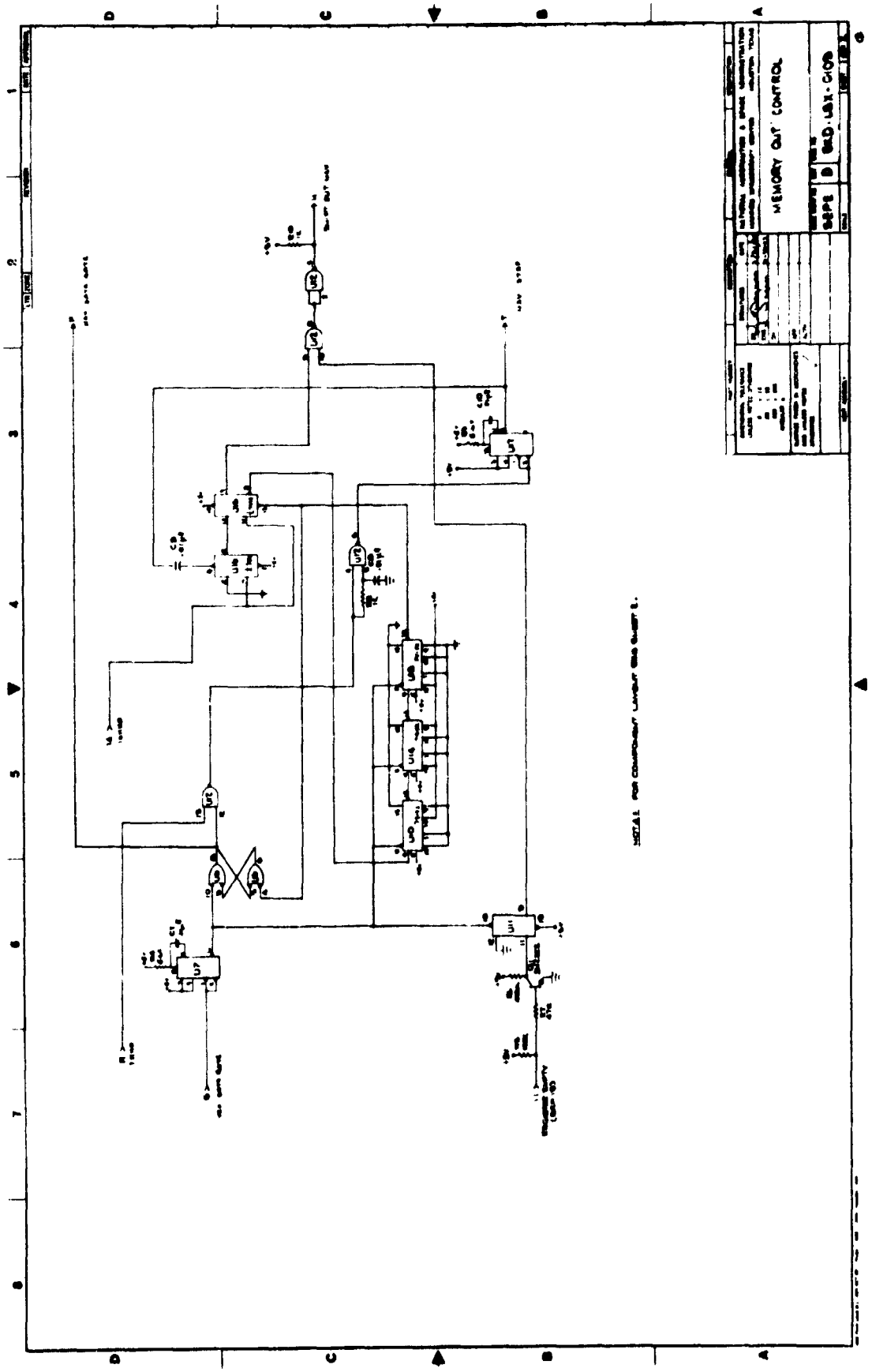

MEMORY IN CONTROL

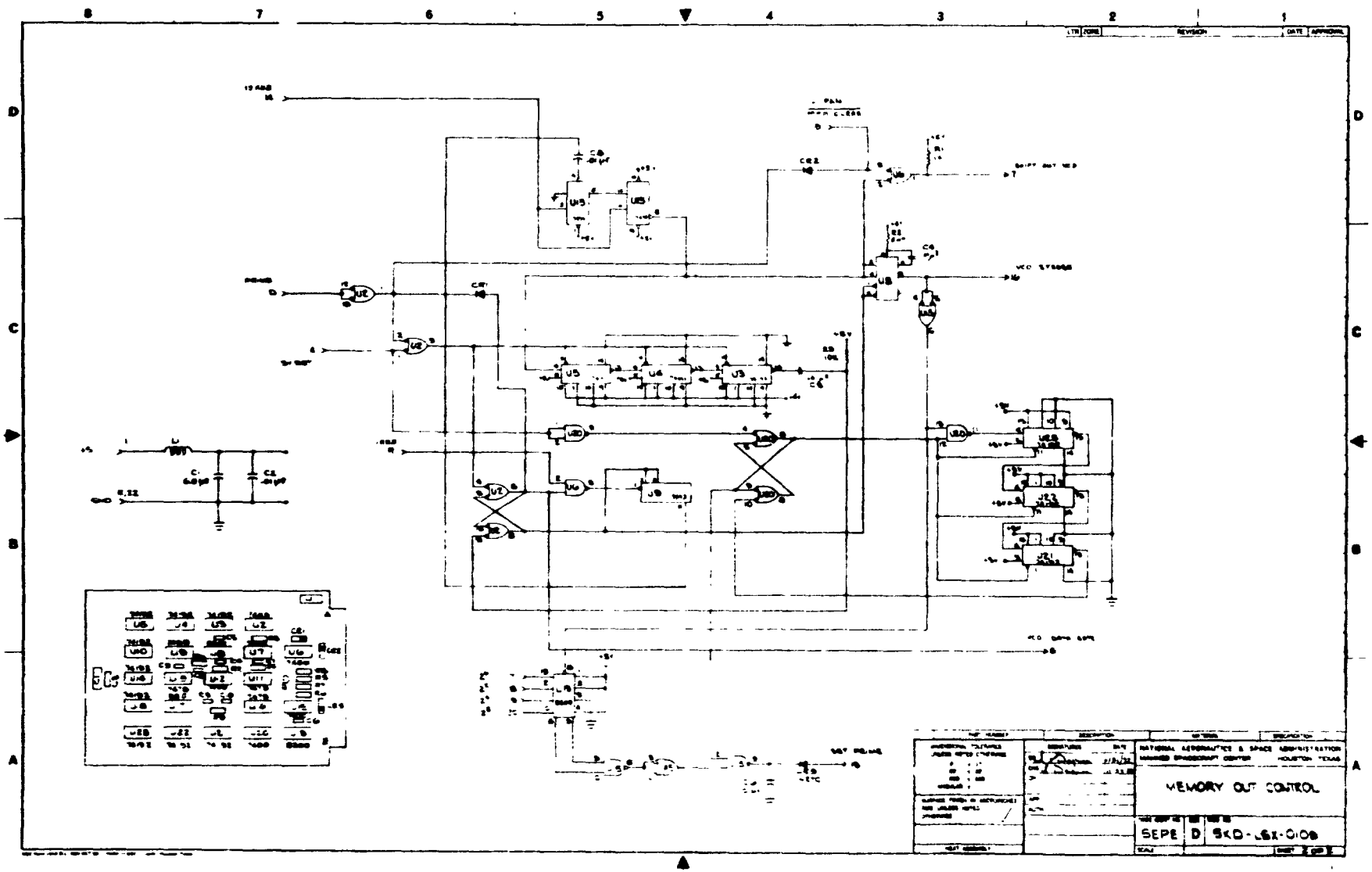


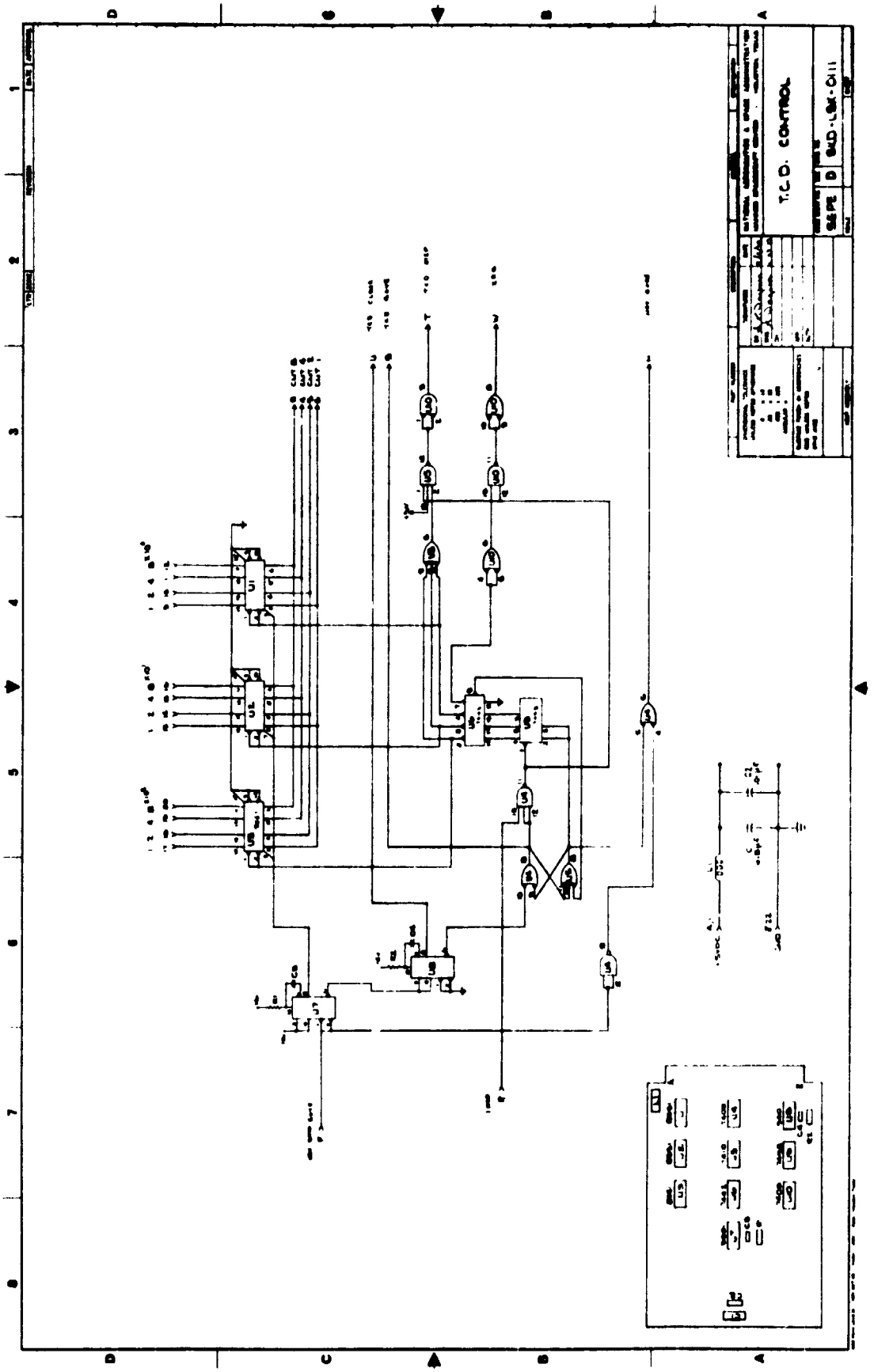

U15
U14
U2
U1
8X136 MEM
FIRST IN FIRST OUT
SHIFT REGISTER
SIZE D
SKD-SH-008

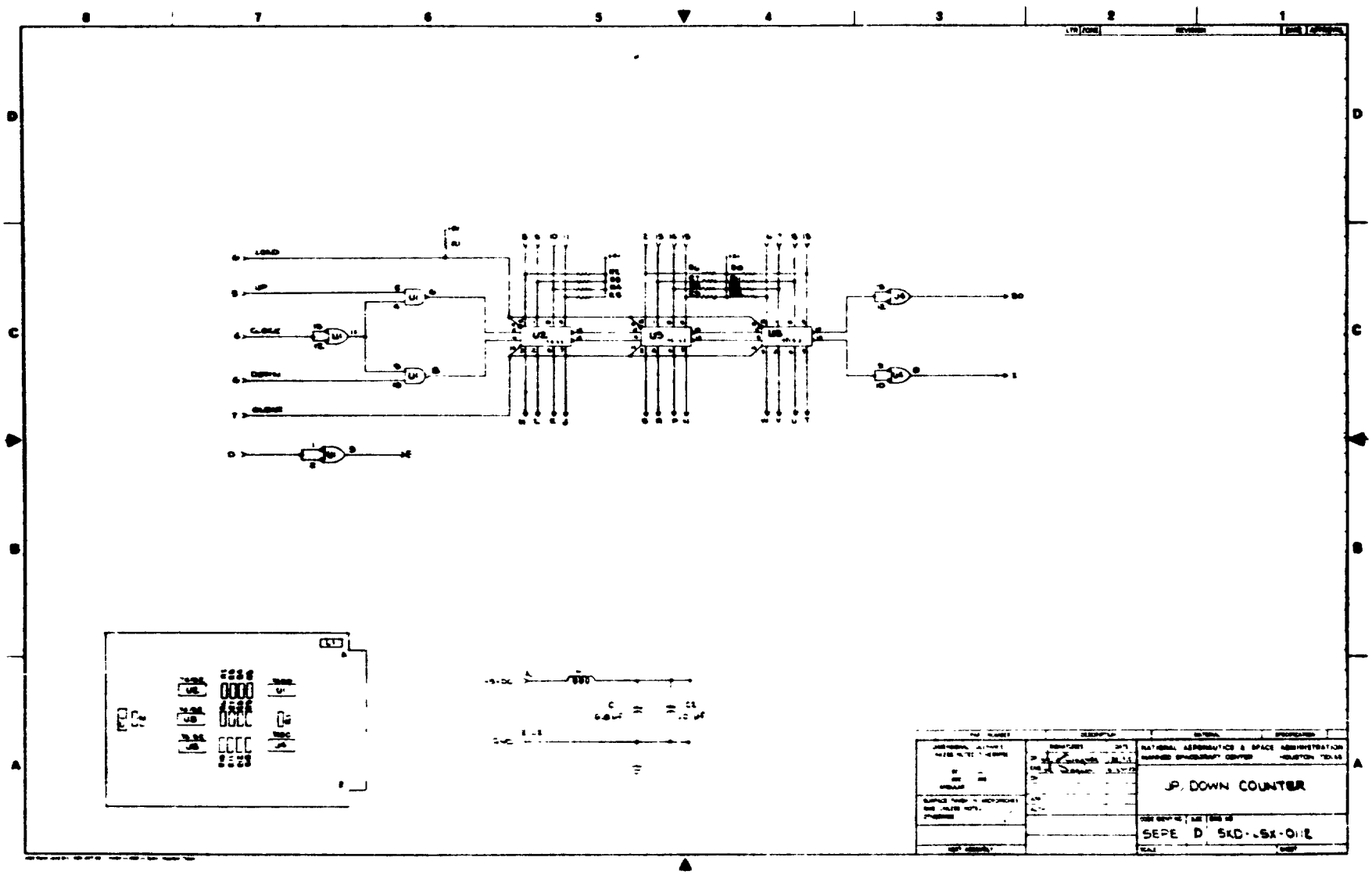

WING DATA


MAG TAPE OUTPUT
SEPE
D


MEMORY OUT CONTROL

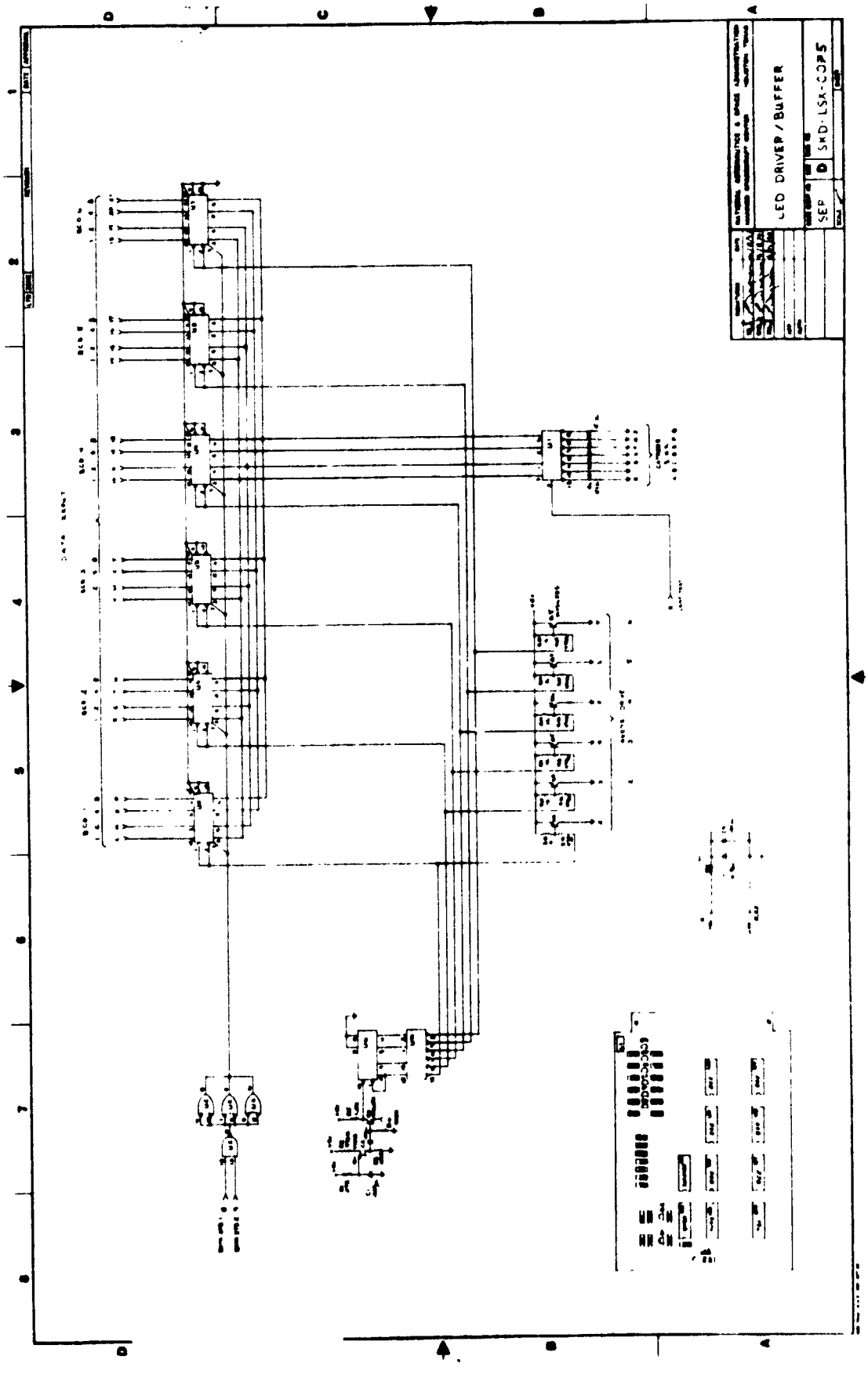

MEMORY OUT CONTROL
SEPE
D
SKD-USX-0108

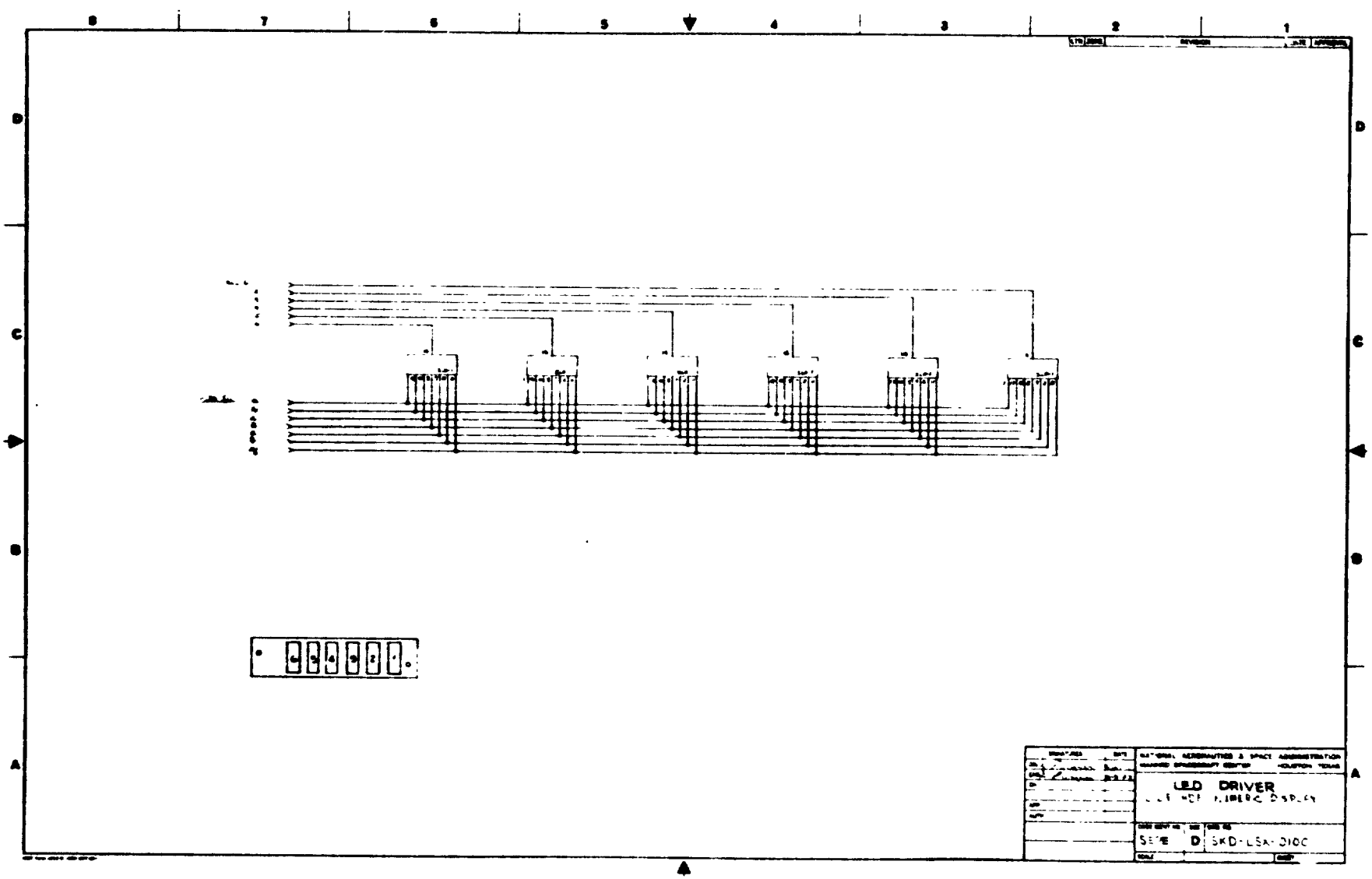

T.C.D. CONTROL



JP, DOWN COUNTER

SEPE D SKD-LSX-011E


LED DRIVER / BUFFER
SKD-LSA-COPS
SEP


LED DRIVER
SKD-LSA-0100

APPENDIX B

WIRE LIST

NO.	FUNCTION	FROM	NOTES
1	+5V		
2			
3	10.4 KV	5B-4	
4	VCO	2B-4	
5			
6	FRAME 32	29T-K	
7	SUBFRAME 1	2T-17	
8	SUBFRAME 2	2T-18	
9	WORD 1	2T-12	
10	WORD 2	2T-11	
11	WORD 3	2T-10	
12			
13	PRIME		
14	SET PRIME		(F.P. SWITCH)
15			
16			
17			
18			
19	SYDET		
20	SYNC STATUS		
21			
22	GND		
A	+5V		
B			
C			
D			
E			
F			
H			
J			
K			
L			
M			
N			
P			
R			
S			
T			
U			
V			
W			
X			
Y			
Z	GND		

TITLE	DRAWING NO.
WIRE LIST - LOCATION 1T	0091

NO.	FUNCTION	FROM	NOTES
1	+5V		
2			
3			
4	10.4 kHz	5B-4	
5			
6	SYDET	1T-19	
7	PRIME	1T-13	
8			
9	WORD START		
10	WORD 3		
11	WORD 2		
12	WORD 1		
13			
14			
15			
16			
17	SUBFRAME 1		
18	SUBFRAME 2		
19			
20			
21			
22	GND		
A	+5V		
B			
C			
D			
E			
F			
H			
J			
K			
L			
M			
N			
P			
R			
S			
T			
U			
V			
W			
X			
Y	GND		
Z			

TITLE	DRAWING NO.
WIRE LIST - LOCATION. 2T	0060

NO.	FUNCTION	FROM	NOTES
1	+5V		
2			
3	SUBFRAME 2	2T-18	
4	SYDET	1T-19	
5	FRAME 32		NOTE: FRAME 1 THROUGH
6	31		32 are active low
7	30		levels.
8	29		
9	28		
10	27		
11	26		
12	25		
13	24		
14	23		
15	22		
16	21		
17	20		
18	19		
19	18		
20	FRAME 17		
21			
22	GND		
A	+5V		
B			
C			
D			
E	FRAME 16		
F	15		
H	14		
J	13		
K	12		
L	11		
M	10		
N	9		
P	8		
R	7		
S	6		
T	5		
U	4		
V	3		
W	2		
X	FRAME 1		
Y			
Z	GND		

TITLE	DRAWING NO.
WIRE LIST - LOCATION 3T	0092

NO.	FUNCTION	FROM	NOTES
1	+5V		
2			
3	VCO CYCLES 4		(F.P. SWITCHES)
4	2		
5	1		
6	VCO CYCLES	8	(F.P. SWITCHES)
7	VCO GATE		
8	VCO	2B-4	
9	WORD START	2T-9	
10	10 KC	1B-13	
11	GATE DELAY 10		(F.P. SWITCHES)
12	20		
13	40		
14	80		
15	1		
16	2		
17	4		
18	GATE DELAY 8		(F.P. SWITCHES)
19			
20			
21			
22	GND		
A	+5V		
B			
C			
D			
E			
F			
H			
J			
K			
L			
M			
N			
P			
R			
S			
T			
U			
V			
W			
X			
Y			
Z	GND		

TITLE	DRAWING NO.
WIRE LIST - LOCATION 4T	0093

NO.	FUNCTION	FROM	NOTES
1	+5V		
2			
3			
4			
5			
6			
7			
8			
9	WORD START	2T-9	
10			
11			
12			
13			
14			
15			
16			
17			
18			
19			
20			
21			
22	GND		
A	+5V		
B			
C			
D			
E			
F			
H			
J			
K			
L			
M			
N			
P			
R			
S	VCO GATE	4T-4	
T	5.2 to CTR		
U	5.2 GATE		
V	DATA AVAIL'		
W	DATA AVAIL'		
X	5200 Hz.	2B-5	
Y			
Z	GND		

TITLE	DRAWING NO.
WIRE LIST - LOCATION 5T	0094

NO.	FUNCTION	FROM	NOTES
1	+5V		
2			
3			
4	VCO DATA 200		VCO GATE PERIOD
5	100		
6	800		BCD DIGITS
7	400		
8	20		LEAST SIGNIFICANT
9	10		
10	80		4 DECADES
11	40		
12	2		
13	1		
14	8		
15	4		
16	08		
17	04		
18	01		
19	VCO DATA 02		
20	WORD START	2T-9	
21			
22	GND		
A	+5V		
B			
C	GATE	4T-7	VCO GATE
D	1 MHz.		F.P. SWITCH (1 MHz. or
E			100 kHz.)
F			
H			
J			
K			
L			
M			
N			
P			
R			
S			
T			
U			
V			
W			
X			
Y			
Z	GND		

TITLE	DRAWING NO.
WIRE LIST - LOCATION 6T	0095

NO.	FUNCTION	FROM	NOTES
1	+5V		
2			
3			
4	5.2 kHz. DATA 200		5.2 kHz. GATE PERIOD
5	100		
6	800		BCD DIGITS
7	400		
8	20		4 DECADES
9	10		
10	80		
11	40		
12	2		
13	1		
14	8		
15	4		
16	08		
17	04		
18	01		
19	5.2 kHz. DATA 02		
20	WORD START	2T-9	
21			
22	GND		
A	+5V		
B			
C	GATE	5T-U	5.2 GATE
D	1 MHz.		F.P. SWITCH (1 MHz. or 100 kHz.)
E			
F			
H			
J			
K			
L			
M			
N			
P			
R			
S			
T			
U			
V			
W			
X			
Y			
Z	GND		

TITLE	DRAWING NO.
WIRE LIST - LOCATION 7T	0095

NO.	FUNCTION	FROM	NOTES
1	+5V		
2			
3			
4	5.2 kHz. CYCLES 200		NUMBER OF 5.2 kHz
5	100		
6	800		CYCLES CONTAINED
7	400		
8	20		IN THE 5.2 GATE
9	10		
10	80		PERIOD
11	40		
12	2		4 DECADES
13	1		
14	8		
15	5.2 kHz. CYCLES 4		
16			
17			
18			
19			
20	WORD START	2T-9	
21			
22	GND		
A	+5V		
B			
C	GATE	5T-U	5.2 GATE
D	5.2 kHz.	5T-T	
E			
F			
H			
J			
K			
L			
M			
N			
P			
R			
S			
T			
U			
V			
W			
X			
Y			
Z	GND		

TITLE	DRAWING NO.
WIRE LIST - LOCATION 8T	0095

NO.	FUNCTION	FROM	NOTES
1	+5V		
2			
3			
4			
5			
6			
7			
8			
9			
10			
11			
12			
13			VCO GATE PERIOD,
14			
15			MOST SIGNIFICANT
16	VCO DATA 8000		
17	4000		BCD DIGIT.
18	1000		
19	VCO DATA 2000		
20	WORD START	2T-9	
21			
22	GND		
A	+5V		
B			
C	VCO 800 CARRY	6T-6	
D	+5V		
E			
F			
H			
J			
K			
L			
M			
N			
P			
R			
S			
T			
U			
V			
W			
X			
Y			
Z	GND		

TITLE	DRAWING NO.
WIRE LIST - LOCATION 9T	0095

NO.	FUNCTION	FROM	NOTES
1	+5V		
2			
3	10.4 kHz	5B-4	
4	VCO	2B-4	
5	COM 4 STROBE		
6	FRAME 32	29T-K	
7	SUBFRAME 1	2T-17	
8	SUBFRAME 2	2T-18	
9	WORD 1	2T-12	
10	WORD 2	2T-11	
11	WORD 3	2T-10	
12	MODE 1		
13	MODE 2Z		
14	MODE 2Y		
15	MODE 2X		
16			
17	MDWD 4		
18	MDWD 8		
19	MDWD 2		
20	MDWD 1		
21			
22	GND		
A	+5V		
B			
C			
D			
E			
F			
H			
J			
K			
L			
M			
N			
P			
R			
S			
T			
U			
V			
W			
X			
Y			
Z	GND		

TITLE	DRAWING NO.
WIRE LIST - LOCATION 10T	0096

NO.	FUNCTION	FROM	NOTES
1	+5V		
2			
3			
4			
5	FRAME 1	29T-L	
6	FRAME 32	29T-K	
7	SUBFRAME 1	2T-17	
8	SUBFRAME 2	2T-18	
9	WORD 1	2T-12	
10			
11	WORD 3	2T-10	
12			
13	COM 2		
14	COM 1		
15	COM 4		
16	DATA STROBE		
17	DATA AVAIL	5T-V	
18	COM 4 STROBE	10T-5	
19			
20			
21			
22	GND		
A	+5V		
B			
C			
D			
E			
F			
H			
J			
K			
L			
M			
N			
P			
R			
S			
T			
U			
V			
W			
X			
Y			
Z	GND		

TITLE	DRAWING NO.
WIRE LIST - LOCATION 11T	0097

NO.	FUNCTION		FROM	NOTES
1	+5V			
2				
3	STROBE (IN)		11T-14	COM 1
4	↑			
5	↓			
6	STROBE (IN)			
7				
8	DATA INPUT	2^0	6T-13	1
9	↑	2^1	6T-12	2
10	↕	2^2	6T-15	4
11	↕	2^3	6T-14	8
12	↕	2^4	6T- 9	10
13	↕	2^5	6T- 8	20 VCO GATE
14	↕	2^6	6T-11	40 PERIOD DATA
15	↕	2^7	6T-10	80
16	↕	2^8	6T- 5	100
17	↕	2^9	6T- 4	200
18	↓	2^{10}	6T- 7	400
19	DATA INPUT	2^{11}	6T- 6	800
20				
21				
22	GND			
A	+5V			
B				
C				
D				
E				
F				
H				
J	DATA OUTPUT	2^0		
K	↑	2^1		
L	↕	2^2		
M	↕	2^3		
N	↕	2^4		
P	↕	2^5		
R	↕	2^6		
S	↕	2^7		
T	↕	2^8		
U	↕	2^9		
V	↓	2^{10}		
W	DATA OUTPUT	2^{11}		
X				
Y				
Z	GND			

TITLE	DRAWING NO.
WIRE LIST - LOCATION 12T	0068

NO.	FUNCTION		FROM	NOTES
1	+5V			
2				
3	STROBE (IN)			
4	↑		11T-13	COM-2
5	↕			
6	STROBE (IN)			
7				
8	DATA INPUT	2^0	24B-M	1
9	↑	2^1	24B-L	2
10	↕	2^2	24B-K	4
11	↕	2^3	24B-J	8
12	↕	2^4	24B-S	10
13	↕	2^5	24B-R	20 ACCUMULATED
14	↕	2^6	24B-P	40 RANGE INFORMATION
15	↕	2^7	24B-N	80
16	↕	2^8	24B-W	100
17	↕	2^9	24B-V	200
18	↓	2^{10}	24B-U	400
19	DATA INPUT	2^{11}	24B-T	800
20				
21				
22	GND			
A	+5V			
B				
C				
D				
E				
F				
H				
J	DATA OUTPUT	2^0		
K	↑	2^1		
L	↕	2^2		
M	↕	2^3		
N	↕	2^4		
P	↕	2^5		
R	↕	2^6		
S	↕	2^7		
T	↕	2^8		
U	↕	2^9		
V	↓	2^{10}		
W	DATA OUTPUT	2^{11}		
X				
Y				
Z	GND			

TITLE	DRAWING NO.
WIRE LIST - LOCATION 13T	0068

NO.	FUNCTION	FROM	NOTES
1	+5V		
2			
3	STROBE (IN)		
4			
5		11T-15	COM 4
6	STROBE (IN)		
7			
8	DATA INPUT 2^0	4T-15	1
9	2^1	4T-16	2
10	2^2	4T-17	4
11	2^3	4T-18	8
12	2^4	4T-11	10 GATE DELAY
13	2^5	4T-12	20 F.P. SWITCHES
14	2^6	4T-13	40
15	2^7	4T-14	80
16	2^8	4T-5	1
17	2^9	4T-4	2 VCO CYCLES
18	2^{10}	4T-3	4 F.P. SWITCH
19	DATA INPUT 2^{11}	4T-6	8
20			
21			
22	GND		
A	+5V		
B			
C			
D			
E			
F			
H			
J	DATA OUTPUT 2^0		
K	2^1		
L	2^2		
M	2^3		
N	2^4		
P	2^5		
R	2^6		
S	2^7		
T	2^8		
U	2^9		
V	2^{10}		
W	DATA OUTPUT 2^{11}		
X			
Y			
Z	GND		

TITLE	DRAWING NO.
WIRE LIST - LOCATION 14T	0068

NO.	FUNCTION	FROM	NOTES
1	+5V		
2			
3	STROBE (IN	11T-16	
4			
5			MULTIPLEXER OUTPUT
6	STROBE (IN)		
7			
8	DATA INPUT 2^0	12T, 13T, 14T-J	
9	2^1	12T, 13T, 14T-K	
10	2^2	12T, 13T, 14T-L	
11	2^3	12T, 13T, 14T-M	
12	2^4	12T, 13T, 14T-N	
13	2^5	12T, 13T, 14T-P	
14	2^6	12T, 13T, 14T-R	
15	2^7	12T, 13T, 14T-S	
16	2^8	12T, 13T, 14T-T	
17	2^9	12T, 13T, 14T-U	
18	2^{10}	12T, 13T, 14T-V	
19	DATA INPUT 2^{11}	12T, 13T, 14T-W	
20			
21	GND		
22	+5V		
A			
B			
C			
D			
E			
F			
H			
J	DATA OUTPUT 2^0		
K	2^1		
L	2^2		
M	2^3		
N	2^4		
P	2^5		
R	2^6		
S	2^7		
T	2^8		
U	2^9		
V	2^{10}		
W	DATA OUTPUT 2^{11}		
X			
Y			
Z	GND		

TITLE	DRAWING NO.
WIRE LIST - LOCATION 15T	0069

NO.	FUNCTION	FROM	NOTES
1	+5V		
2			
3	STROBE (IN)	11T-14	COM 1
4			
5			
6	STROBE (IN)		
7			
8	DATA INPUT 2^0	ZT-13	1
9	2^1	ZT-12	2
10	2^2	ZT-15	4
11	2^3	ZT-14	8
12	2^4	ZT-2	10
13	2^5	ZT-8	20 5.2 kHz RATE
14	2^6	ZT-11	40 PERIOD
15	2^7	ZT-10	80
16	2^8	ZT-5	100
17	2^9	ZT-4	200
18	2^{10}	ZT-7	400
19	DATA INPUT 2^{11}	ZT-6	800
20			
21			
22	GND		
A	+5V		
B			
C			
D			
E			
F			
H			
J	DATA OUTPUT 2^0		
K	2^1		
L	2^2		
M	2^3		
N	2^4		
P	2^5		
R	2^6		
S	2^7		
T	2^8		
U	2^9		
V	2^{10}		
W	DATA OUTPUT 2^{11}		
X			
Y			
Z	GND		

TITLE
WIRE LIST - LOCATION
167

DRAWING NO.
0068

NO.	FUNCTION	FROM	NOTES
1	+5V		
2			
3	STROBE (IN)		
4		11T-13	COM 2
5			
6	STROBE (IN)		
7			
8	DATA INPUT 2^0	25B-M	1
9	2^1	25B-L	2
10	2^2	25B-K	4
11	2^3	25B-J	8
12	2^4	25B-S	10
13	2^5	25B-R	20 ACCUMULATED
14	2^6	25B-P	40 BEARING INFOR-
15	2^7	25B-N	80 MATION
16	2^8	25B-W	100
17	2^9	25B-V	200
18	2^{10}	25B-U	400
19	DATA INPUT 2^{11}	25B-T	800
20			
21			
22	GND		
A	+5V		
B			
C			
D			
E			
F			
H			
J	DATA OUTPUT 2^0		
K	2^1		
L	2^2		
M	2^3		
N	2^4		
P	2^5		
R	2^6		
S	2^7		
T	2^8		
U	2^9		
V	2^{10}		
W	DATA OUTPUT 2^{11}		
X			
Y			
Z	GND		

TITLE	DRAWING NO.
WIRE LIST - LOCATION 17T	0068

NO.	FUNCTION	FROM	NOTES
1	+5V		
2			
3	STROBE (IN)		
4		11T-15	COM 4
5			
6	STROBE (IN)		
7			
8	DATA INPUT 2^0	1T-20	SYNC STATUS
9	2^1	GROUND	
10	2^2	GROUND	
11	2^3	GROUND	
12	2^4		1
13	2^5		2
14	2^6		4
15	2^7		8
16	2^8		10 RUN NUMBER
17	2^9		20 F.P. SWITCHES
18	2^{10}		40
19	DATA INPUT 2^{11}		80
20			
21			
22	GND		
A	+5V		
B			
C			
D			
E			
F			
H			
J	DATA OUTPUT 2^0		
K	2^1		
L	2^2		
M	2^3		
N	2^4		
P	2^5		
R	2^6		
S	2^7		
T	2^8		
U	2^9		
V	2^{10}		
W	DATA OUTPUT 2^{11}		
X			
Y			
Z	GND		

TITLE	DRAWING NO.
WIRE LIST - LOCATION 18T	0068

NO.	FUNCTION	FROM	NOTES
1	+5V		
2			
3	STROBE (IN)	11T-16	
4			
5	STROBE (IN)		
6			MULTIPLEXER OUTPUT
7			
8	DATA INPUT 2^0	16T, 17T, 18T-J	
9	2^1	16T, 17T, 18T-K	
10	2^2	16T, 17T, 18T-L	
11	2^3	16T, 17T, 18T-M	
12	2^4	16T, 17T, 18T-N	
13	2^5	16T, 17T, 18T-P	
14	2^6	16T, 17T, 18T-R	
15	2^7	16T, 17T, 18T-S	
16	2^8	16T, 17T, 18T-T	
17	2^9	16T, 17T, 18T-U	
18	2^{10}	16T, 17T, 18T-V	
19	DATA INPUT 2^{11}	16T, 17T, 18T-W	
20			
21			
22	GND		
A	+5V		
B			
C			
D			
E			
F			
H			
J	DATA OUTPUT 2^0		
K	2^1		
L	2^2		
M	2^3		
N	2^4		
P	2^5		
R	2^6		
S	2^7		
T	2^8		
U	2^9		
V	2^{10}		
W	DATA OUTPUT 2^{11}		
X			
Y			
Z	GND		

TITLE	DRAWING NO.
WIRE LIST - LOCATION 19T	0069

NO.	FUNCTION		FROM	NOTES
1	+5V			
2				
3	STROBE (IN)		11T-14	COM 1
4	↕			
5	↕			
6	STROBE (IN)			
7				
8	DATA INPUT	2^0	8T-13	1
9		2^1	8T-12	2
10		2^2	8T-15	4
11		2^3	8T-14	8
12		2^4	8T-9	10
13		2^5	8T-8	20 NUMBER OF 5.2 kHz
14		2^6	8T-11	40 CYCLES PER
15		2^7	8T-10	80 5.2 GATE PERIOD
16		2^8	8T-5	100
17		2^9	8T-4	200
18		2^{10}	8T-7	400
19	DATA INPUT	2^{11}	8T-6	800
20				
21				
22	GND			
A	+5V			
B				
C				
D				
E				
F				
H				
J	DATA OUTPUT	2^0		
K	↕	2^1		
L	↕	2^2		
M	↕	2^3		
N	↕	2^4		
P	↕	2^5		
R	↕	2^6		
S	↕	2^7		
T	↕	2^8		
U	↕	2^9		
V	↕	2^{10}		
W	DATA OUTPUT	2^{11}		
X				
Y				
Z	GND			

TITLE	DRAWING NO.
WIRE LIST - LOCATION 20T	0068

NO.	FUNCTION	FROM	NOTES
1	+5V		
2			
3	STROBE (IN)		
4	↕	11T-13	COM 2
5			
6	STROBE (IN)		
7			
8	DATA INPUT 2^0	27B-M	1
9	↕ 2^1	27B-L	2
10	2^2	27B-K	4
11	2^3	27B-J	8 ACCUMULATED
12	2^4	27B-S	10 RANGE
13	2^5	27B-R	20 INFORMATION
14	2^6	27B-P	40
15	2^7	27B-N	80
16	2^8	27B-W	100
17	2^9	27B-V	200
18	2^{10}	27B-U	400
19	DATA INPUT 2^{11}	27B-T	800
20			
21			
22	GND		
A	+5V		
B			
C			
D			
E			
F			
H			
J	DATA OUTPUT 2^0		
K	↕ 2^1		
L	2^2		
M	2^3		
N	2^4		
P	2^5		
R	2^6		
S	2^7		
T	2^8		
U	2^9		
V	2^{10}		
W	DATA OUTPUT 2^{11}		
X			
Y			
Z	GND		

TITLE	DRAWING NO.
WIRE LIST - LOCATION 21T	0068

NO.	FUNCTION	FROM	NOTES
1	+5V		
2			
3	STROBE (IN)		
4	↕		
5		11T-15	COM 4
6	STROBE (IN)		
7			
8	DATA INPUT 2^0	30B-M	1
9	↕ 2^1	30B-L	2
10	2^2	30B-K	4
11	2^3	30B-J	8
12	2^4	30B-S	10
13	2^5	30B-R	20 ELAPSED TIME
14	2^6	30B-P	40
15	2^7	30B-N	80
16	2^8	30B-W	100
17	2^9	30B-V	200
18	2^{10}	30B-U	400
19	DATA INPUT 2^{11}	30B-T	800
20			
21			
22	GND		
A	+5V		
B			
C			
D			
E			
F			
H			
J	DATA OUTPUT 2^0		
K	↕ 2^1		
L	2^2		
M	2^3		
N	2^4		
P	2^5		
R	2^6		
S	2^7		
T	2^8		
U	2^9		
V	↕ 2^{10}		
W	DATA OUTPUT 2^{11}		
X			
Y			
Z	GND		

TITLE	DRAWING NO.
WIRE LIST - LOCATION 22T	0068

NO.	FUNCTION	FROM	NOTES
1	+5V		
2			
3	STROBE (IN)	11T-1B	
4	↕		
5			MULTIPLEXER OUTPUT
6	STROBE (IN)		
7			
8	DATA INPUT 2^0	20T, 21T, 22T-J	
9	↕ 2^1	20T, 21T, 22T-K	
10	2^2	20T, 21T, 22T-L	
11	2^3	20T, 21T, 22T-M	
12	2^4	20T, 21T, 22T-N	
13	2^5	20T, 21T, 22T-P	
14	2^6	20T, 21T, 22T-R	
15	2^7	20T, 21T, 22T-S	
16	2^8	20T, 21T, 22T-T	
17	2^9	20T, 21T, 22T-U	
18	2^{10}	20T, 21T, 22T-V	
19	DATA INPUT 2^{11}	20T, 21T, 22T-W	
20			
21			
22	GND		
A	+5V		
B			
C			
D			
E			
F			
H			
J	DATA OUTPUT 2^0		
K	↕ 2^1		
L	2^2		
M	2^3		
N	2^4		
P	2^5		
R	2^6		
S	2^7		
T	2^8		
U	2^9		
V	2^{10}		
W	DATA OUTPUT 2^{11}		
X			
Y			
Z	GND		

TITLE	DRAWING NO.
WIRE LIST - LOCATION 23T	0069

NO.	FUNCTION	FROM	NOTES
1	+5V		
2			
3	STROBE (IN)	11T-14	COM 1
4			
5			
6	STROBE (IN)		
7			
8	DATA INPUT $2^{}$	6T-18	01 } LEAST SIGNIFICANT
9	$2^{}$	6T-19	02 } DIGIT OF VCO GATE
10	$2^{}$	6T-17	04 } PERIOD
11	$2^{}$	6T-16	08 }
12	$2^{}$	9T-18	1000 } MOST
13	$2^{}$	9T-19	2000 } SIGNIFICANT
14	$2^{}$	9T-17	4000 } DIGIT OF VCO
15	$2^{}$	9T-16	8000 } GATE PERIOD
16	$2^{}$	7T-18	01 }
17	$2^{}$	7T-19	02 } LEAST SIGNIFICANT
18	$2^{}$	7T-17	04 } DIGIT OF 5.2 kHz.
19	DATA INPUT $2^{}$	7T-18	08 } GATE PERIOD
20			
21			
22	GND		
A	+5V		
B			
C			
D			
E			
F			
H			
J	DATA OUTPUT 2^{0}		
K	2^{1}		
L	2^{2}		
M	2^{3}		
N	2^{4}		
P	2^{5}		
R	2^{6}		
S	2^{7}		
T	2^{8}		
U	2^{9}		
V	2^{10}		
W	DATA OUTPUT 2^{11}		
X			
Y			
Z	GND		

TITLE	DRAWING NO.
WIRE LIST - LOCATION 24T	0068

NO.	FUNCTION		FROM	NOTES
1	+5V			
2				
3	STROBE (IN)			
4	↕		11I-13	COM 2
5				
6	STROBE (IN)			
7				
8	DATA INPUT	2^0	28B-M	1000
9	↕	2^1	28B-L	2000
10		2^2	28B-K	4000
11		2^3	28B-J	8000
12		2^4	28B-S	10000
13		2^5	28B-R	20000 ACCUMULATED
14		2^6	28B-P	40000 RANGE
15		2^7	28B-N	80000 INFORMATION
16		2^8	28B-W	100000
17		2^9	28B-V	200000
18	↕	2^{10}	28B-U	400000
19	DATA INPUT	2^{11}	28B-T	800000
20				
21				
22	GND			
A	+5V			
B				
C				
D				
E				
F				
H				
J	DATA OUTPUT	2^0		
K	↕	2^1		
L		2^2		
M		2^3		
N		2^4		
P		2^5		
R		2^6		
S		2^7		
T		2^8		
U		2^9		
V	↕	2^{10}		
W	DATA OUTPUT	2^{11}		
X				
Y				
Z	GND			

TITLE	DRAWING NO.
WIRE LIST - LOCATION 25T	0068

NO.	FUNCTION	FROM	NOTES
1	+5V		
2			
3	STROBE (IN)		
4			
5		11T-15	COM 4
6	STROBE (IN)		
7			
8	DATA INPUT 2^0	10T-20	MDWD 1
9	2^1	10T-19	MDWD 2 — RECEIVER MODE
10	2^2	10T-17	MDWD 4 — RECEIVER MODE
11	2^3	GROUND	
12	2^4	10T-18	MDWD 8
13	2^5	GROUND	RECEIVER MODE
14	2^6	GROUND	RECEIVER MODE
15	2^7	GROUND	
16	2^8	+5VDC	1
17	2^9	+5VDC	2 — WANG SYNC
18	2^{10}	GROUND	4
19	DATA INPUT 2^{11}	+5VDC	8
20			
21			
22	GND		
A	+5V		
B			
C			
D			
E			
F			
H			
J	DATA OUTPUT 2^0		
K	2^1		
L	2^2		
M	2^3		
N	2^4		
P	2^5		
R	2^6		
S	2^7		
T	2^8		
U	2^9		
V	2^{10}		
W	DATA OUTPUT 2^{11}		
X			
Y			
Z	GND		

TITLE	DRAWING NO.
WIRE LIST - LOCATION 26T	0068

NO.	FUNCTION	FROM	NOTES
1	+5V		
2			
3	STROBE (IN)	11T-16	
4	↕		
5			
6	STROBE (IN)		MULTIPLEXER OUTPUT
7			
8	DATA INPUT 2^0	24T, 25T, 26T-J	
9	↕ 2^1	24T, 25T, 26T-K	
10	2^2	24T, 25T, 26T-L	
11	2^3	24T, 25T, 26T-M	
12	2^4	24T, 25T, 26T-N	
13	2^5	24T, 25T, 26T-P	
14	2^6	24T, 25T, 26T-R	
15	2^7	24T, 25T, 26T-S	
16	2^8	24T, 25T, 26T-T	
17	2^9	24T, 25T, 26T-U	
18	2^{10}	24T, 25T, 26T-V	
19	DATA INPUT 2^{11}	24T, 25T, 26T-W	
20			
21			
22	GND		
A	+5V		
B			
C			
D			
E			
F			
H			
J	DATA OUTPUT 2^0		
K	↕ 2^1		
L	2^2		
M	2^3		
N	2^4		
P	2^5		
R	2^6		
S	2^7		
T	2^8		
U	2^9		
V	2^{10}		
W	DATA OUTPUT 2^{11}		
X			
Y			
Z	GND		

TITLE	DRAWING NO.
WIRE LIST - LOCATION 27T	0069

NO.	FUNCTION	FROM	NOTES
1	+5V		
2			
3	SY DET	1T-19	
4			
5			
6			
7	SUBFRAME #1	2T-17	
8	FRAME SELECT 80		F.P. SWITCHES
9	40		
10	20		
11	10		
12	8		
13	4		
14	2		
15	FRAME SELECT 1		F.P. DIGIT SWITCHES
16	DATA STROBE	11T-16	
17	WORD SELECT		F.P. WORD SELECT SWITCH
18	SUBFRAME SELECT		F.P. WORD SELECT SWITCH
19	DATA DISPLAY		
20			
21			
22	GND		
A	+5V		
B			
C			
D			
E			
F			
H			
J	FRAME COUNT 80		
K	40		
L	20		
M	10		
N	8		
P	4		
R	2		
S	FRAME COUNT 1		
T			
U			
V			
W			
X			
Y			
Z	GND		

TITLE	DRAWING NO.
WIRE LIST - LOCATION 28T	0098

NO.	FUNCTION		FROM	NOTES
1	+5V			
2				
3	INPUTS	A	1T-13	PRIME
4		B		
5		C		
6		D		
7		E		
8		F	10T-18	MDWD 8
9		G	3T-5	FRAME 32
10		H	3T-8	FRAME 1
11		I		
12		J		
13		K		
14		L		
15		M	10T-12	MODE 1
16		N	10T-15	MODE 2X
17		O	10T-14	MODE 2Y
18		P	10T-13	MODE 2Z
19		R		
20	INPUTS	S	16B-D	PROGRAM ERROR
21				
22	GND			
A	+5V			
B				
C	OUTPUTS	A		PRIME (F.P. LIGHT)
D		B		
E		C		
F		D		
H		E		
J		F		MDWD 8 (FP LIGHT)
K		G		FRAME 32
L		H		FRAME 1
M		I		
N		J		
P		K		
R		L		
S		M		MODE 1 (FP LIGHT)
T		N		MODE 2X (FP LIGHT)
U		O		MODE 2Y (FP LIGHT)
V		P		MODE 2Z (FP LIGHT)
W		R		
X	OUTPUTS	S		PROGRAM ERROR (FP LIGHT)
Y				
Z	GND			

TITLE	DRAWING NO.
WIRE LIST - LOCATION 29T	0099

NO.	FUNCTION		FROM	NOTES
1	+5V			
2	LED ANODE	1st		LED's (F.P.)
3	↑	2nd		↑
4	‖	3rd		‖ CURRENT SOURCE
5	‖	4th		‖
6	↓	5th		↓
7	LED ANODE	6th		LED's (F.P.)
8	LOAD A		28T-19	
9	LOAD B			
10	DATA IN	2^{12}	19T-J	
11	↑	2^{13}	19T-K	
12	‖	2^{14}	19T-L	
13	‖	2^{15}	19T-M	
14	‖	2^{16}	19T-N	
15	‖	2^{17}	19T-P	
16	‖	2^{18}	19T-R	
17	‖	2^{19}	19T-S	
18	‖	2^{20}	19T-T	
19	‖	2^{21}	19T-U	
20	↓	2^{22}	19T-V	
21	DATA IN	2^{23}	19T-W	
22	GND			
A	+5V			
B	SEGMENT	A		LED's (F.P.)
C	↑	B		↑
D	‖	C		‖
E	‖	D		‖ CURRENT SINK
F	‖	E		‖
H	↓	F		↓
J	SEGMENT	G		LED's (F.P.)
K	LAMP TEST			F.P. SWITCH
L	DATA IN	2^{0}	15T-J	
M	↑	2^{1}	15T-K	
N	‖	2^{2}	15T-L	
P	‖	2^{3}	15T-M	
R	‖	2^{4}	15T-N	
S	‖	2^{5}	15T-P	
T	‖	2^{6}	15T-R	
U	‖	2^{7}	15T-S	
V	‖	2^{8}	15T-T	
W	‖	2^{9}	15T-U	
X	↓	2^{10}	15T-V	
Y	DATA IN	2^{11}	15T-W	
Z				

TITLE	DRAWING NO.
WIRE LIST - LOCATION 30T	0075

NO.	FUNCTION		FROM	NOTES
1	+5V			
2	LED ANODE	1st		LED's (F.P.)
3	↑	2nd		↑
4	|	3rd		| CURRENT SOURCE
5	|	4th		|
6	↓	5th		↓
7	LED ANODE	6th		LED's (F.P.)
8	LOAD A		28T-19	
9	LOAD B			
10	DATA IN	2^{12}	27T-J	
11	↑	2^{13}	27T-K	
12	|	2^{14}	27T-L	
13	|	2^{15}	27T-M	
14	|	2^{16}	27T-N	
15	|	2^{17}	27T-P	
16	|	2^{18}	27T-R	
17	|	2^{19}	27T-S	
18	|	2^{20}	27T-T	
19	|	2^{21}	27T-U	
20	↓	2^{22}	27T-V	
21	DATA IN	2^{23}	27T-W	
22	GND			
A	+5V			
B	SEGMENT	A		LED's (F.P.)
C	↑	B		↑
D	|	C		|
E	|	D		| CURRENT SINK
F	|	E		|
H	↓	F		↓
J	SEGMENT	G		LED's (F.P.)
K	LAMP TEST			F.P. SWITCH
L	DATA IN	2^{0}	23T-J	
M	↑	2^{1}	23T-K	
N	|	2^{2}	23T-L	
P	|	2^{3}	23T-M	
R	|	2^{4}	23T-N	
S	|	2^{5}	23T-P	
T	|	2^{6}	23T-R	
U	|	2^{7}	23T-S	
V	|	2^{8}	23T-T	
W	|	2^{9}	23T-U	
X	↓	2^{10}	23T-V	
Y	DATA IN	2^{11}	23T-W	
Z	GND			

TITLE	DRAWING NO.
WIRE LIST - LOCATION 31T	0075

NO.	FUNCTION		FROM	NOTES
1	+5V			
2	LED ANODE	1st		LED's (F.P.)
3	↑	2nd		↑
4	|	3rd		| CURRENT SOURCE
5	|	4th		|
6	↓	5th		↓
7	LED ANODE	6th		LED's (F.P.)
8	LOAD A		5B-4	10.4 kHz
9	LOAD B			
10	DATA IN	2^{12}		
11		2^{13}		
12		2^{14}		
13		2^{15}		
14		2^{16}		
15		2^{17}		
16		2^{18}		
17		2^{19}		
18		2^{20}		
19		2^{21}		
20		2^{22}		
21	DATA IN	2^{23}		
22	GND			
A	+5V			
B	SEGMENT	A		LED's (F.P.)
C	↑	B		↑
D	|	C		|
E	|	D		| CURRENT SINK
F	|	E		|
H	↓	F		↓
	SEGMENT	G		LED's (F.P.)
K	LAMP TEST			F.P. SWITCH
L	DATA IN	2^0	28T-S	1
M	↑	2^1	28T-R	2
N	|	2^2	28T-P	4 FRAME COUNT
P	|	2^3	28T-N	8
R	|	2^4	28T-M	10
S	|	2^5	28T-L	20
T	|	2^6	28T-K	40
U	|	2^7	28T-J	80
V	|	2^8		
W	|	2^9		
X	↓	2^{10}		
Y	DATA IN	2^{11}		
Z	GND			

TITLE	DRAWING NO.
WIRE LIST - LOCATION 32T	0075

NO.	FUNCTION	FROM	NOTES
1	+5V		
2			
3			
4			
5			
6			
7			
8	.1 Hz.		
9	1 Hz.		
10	10 Hz.		
11	100 Hz.		
12	1 kHz.		
13	10 kHz.		
14	100 kHz.		
15	1 MHz.		
16			
17			
18			
19			
20			
21			
22	GND		
A	+5V		
B			
C			
D			
E			
F			
H			
J	GND		FOR COAX SHIELDING
K			
L			
M			
N			
P			
R			
S			
T	GND		FOR COAX SHIELDING
U			
V			
W			
X			
Y			
Z	GND		

TITLE	DRAWING NO.
WIRE LIST - LOCATION 1B	0101

NO.	FUNCTION	FROM	NOTES
1	+5V		
2	+12 V		
3			
4	VCO (OUT)		
5	5.2 kHz. (OUT)		
6			
7			
8			
9			
10			
11	TCD (OUT)		
12	TCD (IN)		B.P. BNC CONNECTOR
13			
14			
15	SPARE (OUT)		B.P. CONNECTOR
16	SPARE (IN)		
17			
18			
19			
20			
21	-12 V		
22	GND		
A	+5V		
B	+12V		
C			
D	VCO (IN)		B.P. BNC CONNECTOR
E	5.2 kHz. (IN)		B.P. BNC CONNECTOR
F			
H			
J			
K			
L			
M			
N			
P			
R			
S			
T			
U			
V			
W			
X			
Y	-12V		
Z	GND		

TITLE	DRAWING NO.
WIRE LIST - LOCATION 2B	0073

NO.	FUNCTION	FROM	NOTES
1	+5V		
2			
3			
4	FSK - TCD	2B-11	
5			
6			
7			
8			
9			
10			
11			
12			
13			
14			
15			
16			
17			
18			
19			
20	PCM TCD		
21			
22	GND		
A	+5V		
B			
C			
D			
E			
F			
H			
J			
K			
L			
M			
N			
P			
R			
S			
T			
U			
V			
W			
X			
Y			
Z	GND		

TITLE	DRAWING NO.
WIRE LIST - LOCATION 3B	0012

NO.	FUNCTION	FROM	NOTES
1	+5V		
2			
3	TCD CLK		
4	TCD STROBE		
5			
6			
7			
8	OR		
9	OF		
10	R+		
11	R-		
12	B+		
13	B-		
14			
15			
16	TCD STROBE		
17			
18			
19			
20	PCM TCD	3B-20	
21			
22	GND		
A	+5V		
B			
C			
D			
E			
F			
H			
J			
K			
L			
M			
N			
P			
R			
S			
T			
U			
V			
W			
X			
Y			
Z	GND		

TITLE	DRAWING NO.
WIRE LIST - LOCATION 4B	0103

NO.	FUNCTION	FROM	NOTES
1	+5V		
2			
3	TCD CLK	4B-3	
4	10.4 kHz		
5			
6			
7			
8			
9			
10			
11			
12			
13			
14			
15			
16			
17			
18			
19			
20			
21			
22	GND		
A	+5V		
B			
C	5.2 kHz.	2B-5	
D			
E			
F			
H			
J			
K			
L			
M			
N			
P			
R			
S			
T			
U			
V			
W			
X			
Y			
Z	GND		

TITLE	DRAWING NO.
WIRE LIST - LOCATION 5B	0104

NO.	FUNCTION	FROM	NOTES
1	+5V		
2			
3	DATA #1		
4	DATA STROBE	11I-16	
5	TCD STROBE	4B-4	
6	NAV 6		
7	NAV 5		
8	READ INPUT VCO		
9	OR	4B-8	
10	OF	4B-9	
11	R+	4B-10	
12	R-	4B-11	
13	B+	4B-12	
14	B-	4B-13	
15	PRIME	1T-13	
16	Ø2 CLOCK		
17	Ø1 CLOCK		
18			
19			
20			
21	-12V		
22	GND		
A	+5V		
B			
C	DATA 2		
D	NAV 1		
E	NAV 2		
F	NAV 3		
H	NAV 4		
J	READ INPUT NAV		
K			
L			
M			
N			
P			
R	10 kHz	1B-13	
S			
T			
U			
V			
W			
X			
Y	-12V		
Z	GND		

TITLE	DRAWING NO.
WIRE LIST - LOCATION 6B	0105

NO.	FUNCTION		FROM	NOTES
1	+5V			
2				
3	DATA 1 STROBE		6B-3	DATA 1
4	DATA OUT	2^{6}		
5	↕	2^{7}		
6		2^{8}		
7		2^{9}		
8		2^{10}		
9	DATA OUT	2^{11}		
10	DATA IN	$B2^{11}$	27T-W	
11	↕	$A2^{11}$	19T-W	
12		$B2^{10}$	27T-V	
13		$A2^{10}$	19T-V	
14		$B2^{9}$	27T-U	
15		$A2^{9}$	19T-U	
16		$B2^{8}$	27T-T	
17		$A2^{8}$	19T-T	
18		$B2^{7}$	27T-S	
19		$A2^{7}$	19T-S	
20		$B2^{6}$	27T-R	
21	DATA IN	$A2^{6}$	19T-R	
22	GND			
A	+5V			
B				
C	DATA 2 STROBE		6B-C	DATA 2
D	DATA OUT	2^{5}		
E		2^{4}		
F		2^{3}		
H		2^{2}		
J		2^{1}		
K	DATA OUT	2^{0}		
L	DATA IN	$A2^{0}$	19T-J	
M	↕	$B2^{0}$	23T-J	
N		$A2^{1}$	19T-K	
P		$B2^{1}$	23T-K	
R		$A2^{2}$	19T-L	
S		$B2^{2}$	23T-L	
T		$A2^{3}$	19T-M	
U		$B2^{3}$	23T-M	
V		$A2^{4}$	19T-N	
W		$B2^{4}$	23T-N	
X		$A2^{5}$	19T-P	
Y	DATA IN	$B2^{5}$	23T-P	
Z	GND			

TITLE	DRAWING NO.
WIRE LIST - LOCATION 7B	0107

NO.	FUNCTION		FROM	NOTES
1	+5V			
2				
3	DATA 1 STROBE		6B-3	DATA 1
4	DATA OUT	2 6		
5	↑	2 7		
6	↕	2 8		
7	↕	2 9		
8	↓	2 10		
9	DATA OUT	2 11		
10	DATA IN	B2 11	23T-W	
11	↑	A2 11	15T-W	
12	↕	B2 10	23T-V	
13	↕	A2 10	15T-V	
14	↕	B2 9	23T-U	
15	↕	A2 9	15T-U	
16	↕	B2 8	23T-T	
17	↕	A2 8	15T-T	
18	↕	B2 7	23T-S	
19	↕	A2 7	15T-S	
20	↓	B2 6	23T-R	
21	DATA IN	A2 6	15T-R	
22	GND			
A	+5V			
B				
C	DATA 2 STROBE		6B-C	DATA 2
D	DATA OUT	2 5		
E	↑	2 4		
F	↕	2 3		
H	↕	2 2		
J	↓	2 1		
K	DATA OUT	2 0		
L	DATA IN	A2 0	15T-J	
M	↑	B2 0	23T-J	
N	↕	A2 1	15T-K	
P	↕	B2 1	23T-K	
R	↕	A2 2	15T-L	
S	↕	B2 2	23T-L	
T	↕	A2 3	15T-M	
U	↕	B2 3	23T-M	
V	↕	A2 4	15T-N	
W	↕	B2 4	23T-N	
X	↓	A2 5	15T-P	
Y	DATA IN	B2 5	23T-P	
Z	GND			

TITLE	DRAWING NO.
WIRE LIST - LOCATION 8B	0107

NO.	FUNCTION		FROM	NOTES
1	+5V			
2				
3	DATA IN	2^3	7B-F	
4	↑	2^2	7B-H	
5	↓	2^1	7B-J	
6	DATA IN	2^0	7B-K	
7	REGISTER FULL			
8	Ø2		6B-16	
9				
10				
11				
12				
13				
14				
15				
16	REGISTER EMPTY		12B-H	
17	DATA OUT	2^0		
18	↑	2^1		
19	↓	2^2		
20	DATA OUT	2^3		
21	-12V			
22				
A	+5V			
B				
C	DATA IN	2^4	7B-E	
D	↑	2^5	7B-C	
E	↓	2^6	7B-4	
F	DATA IN	2^7	7B-5	
H	READ IN		6B-8	
J	Ø 1		6B-17	
K				
L				
M				
N				
P				
R				
S				
T	SHIFT OUT		12B-7	
U	DATA OUT	2^7		
V	↑	2^6		
W	↓	2^5		
X	DATA OUT	2^4		
Y	-12V			
Z				

TITLE	DRAWING NO.
WIRE LIST - LOCATION 9B	0108

NO.	FUNCTION		FROM	NOTES
1	+5V			
2				
3	DATA IN	2^3	7B-9	
4	↕	2^2	7B-8	
5	↕	2^1	7B-7	
6	DATA IN	2^0	7B-6	
7	REGISTER FULL			
8	Ø2		6B-16	
9				
10				
11				
12				
13				
14				
15				
16	REGISTER EMPTY		13B-H	
17	DATA OUT	2^0		
18	↕	2^1		
19	↕	2^2		
20	DATA OUT	2^3		
21	-12V			
22				
A	+5V			
B				
C	DATA IN	2^4	8B-K	
D	↕	2^5	8B-J	
E	↕	2^6	8B-H	
F	DATA IN	2^7	8B-F	
H	READ IN		6B-8	
J	Ø1		6B-17	
K				
L				
M				
N				
P				
R				
S				
T	SHIFT OUT		13B-7	
U	DATA OUT	2^7		
V	↕	2^6		
W	↕	2^5		
X	DATA OUT	2^4		
Y	-12 V			
Z				

TITLE	DRAWING NO.
WIRE LIST TOB LOCATION	0108

NO.	FUNCTION	FROM	NOTES
1	+5V		
2			
3	DATA IN 2^3	8B-5	
4	↕ 2^2	8B-4	
5	↕ 2^1	8B-D	
6	DATA IN 2^0	8B-E	
7	REGISTER FULL	-	
8	Ø2	6B-16	
9			
10			
11			
12			
13			
14			
15			
16	REGISTER EMPTY	14B-H	
17	DATA OUT 2^0		
18	↕ 2^1		
19	↕ 2^2		
20	DATA OUT 2^3		
21	-12V		
22			
A	+5V		
B			
C	DATA IN 2^4	8B-6	
D	↕ 2^5	8B-7	
E	↕ 2^6	8B-8	
F	DATA IN 2^7	8B-9	
H	READ IN	6B-8	
J	Ø1	6B-17	
K			
L			
M			
N			
P			
R			
S			
T	SHIFT OUT	14B7	
U	DATA OUT 2^7		
V	↕ 2^5		
W	↕ 2^5		
X	DATA OUT 2^4		
Y	-12V		
Z			

TITLE	DRAWING NO.
WIRE LIST - LOCATION 11B	0108

NO.	FUNCTION		FROM	NOTES
1	+5V			
2				
3	DATA IN	2^3	9B-20	
4	↕	2^2	9B-19	
5	↕	2^1	9B-18	
6	DATA IN	2^0	9B-17	
7	REGISTER FULL		9B-T	
8	Ø2		6B-16	
9				
10				
11				
12				
13				
14				
15				
16	REGISTER EMPTY			
17	DATA OUT	2^0		
18	↕	2^1		
19	↕	2^2		
20	DATA OUT	2^3		
21	-12V			
22				
A	+5V			
B				
C	DATA IN	2^4	9B-X	
D	↕	2^5	9B-W	
E	↕	2^6	9B-V	
F	DATA IN	2^7	9B-U	
H	READ IN		9B-16	
J	Ø1		6B-17	
K				
L				
M				
N				
P				
R				
S				
T	SHIFT OUT		21B-7	
U	DATA OUT	2^7		
V	↕	2^6		
W	↕	2^5		
X	DATA OUT	2^4		
Y	-12V			
Z				

TITLE	DRAWING NO.
WIRE LIST - LOCATION 12B	0108

NO.	FUNCTION		FROM	NOTES
1	+5V			
2				
3	DATA IN	2^3	10B-20	
4	↕	2^2	10B-19	
5	↕	2^1	10B-18	
6	DATA IN	2^0	10B-17	
7	Ø2		6B-16	
8				
9				
10				
11				
12				
13				
14				
15				
16	REGISTER EMPTY			
17	DATA OUT	2^4		
18	↕	2^1		
19	↕	2^2		
20	DATA OUT	2^3		
21	-12V			
22				
A	+5V			
B				
C	DATA IN	2^6	10B-X	
D	↕	2^5	10B-W	
E	↕	2^6	10B-V	
F	DATA IN	2^7	10B-U	
H	READ IN		10B-16	
J	Ø1		6B-17	
K				
L				
M				
N				
P				
R				
S				
T	SHIFT OUT		21B-7	
U	DATA OUT	2^7		
V	↕	2^6		
W	↕	2^5		
X	DATA OUT	2^4		
Y	-12V			
Z				

TITLE	DRAWING NO.
WIRE LIST - LOCATION 13B	0108

NO.	FUNCTION	FROM	NOTES
1	+5V		
2			
3	DATA IN 2^3	11B-20	
4	↕ 2^2	11B-19	
5	↕ 2^1	11B-18	
6	DATA IN 2^0	11B-17	
7	REGISTER FULL	11B-T	
8	Ø2	6B-1	
9			
10			
11			
12			
13			
14			
15			
16	REGISTER EMPTY		
17	DATA 2^0		
18	↕ 2^1		
19	↕ 2^2		
20	DATA OUT 2^3		
21	-12V		
22			
A	+5V		
B			
C	DATA IN 2^4	11B-X	
D	↕ 2^5	11B-W	
E	↕ 2^6	11B-V	
F	DATA IN 2^7	11B-U	
H	READ IN	11B-16	
J	Ø1	6B-17	
K			
L			
M			
N			
P			
R			
S			
T	SHIFT OUT	21B-7	
U	DATA OUT 2^7		
V	↕ 2^6		
W	↕ 2^5		
X	DATA OUT 2^4		
Y	-12V		
Z			

TITLE	DRAWING NO.
WIRE LIST - LOCATION 14B	0108

NO.	FUNCTION		FROM	NOTES
1	+5V			
2				
3	STROBE		21B-16	
4	RQT		16B-4	
5	GKB_0			TO WANG
6	GKB_1			
7	GKB_2			
8	GKB_3			TO WANG
9	DATA IN	2^{12}	13B-X	1
10		2^{13}	13B-W	2 1 K
11		2^{14}	13B-V	4
12		2^{15}	13B-U	8
13		2^{16}	14B-17	1
14		2^{17}	14B-18	2 10 K
15		2^{18}	14B-19	4
16		2^{19}	14B-20	8
17		2^{20}	14B-X	1
18		2^{21}	14B-W	2 100 K
19		2^{22}	14B-V	4
20	DATA IN	2^{23}	14B-U	8
21				
22	GND			
A	+5V			
B				
C	DATENB		16B-C	
D				
E	GKA_0			TO WANG
F	GKA_1			
H	GKA_2			TO WANG
J	GKA_3			
K	DATA IN	2^{0}	12B-17	1
L		2^{1}	12B-18	2 1
M		2^{2}	12B-19	4
N		2^{3}	12B-20	8
P		2^{4}	12B-X	1
R		2^{5}	12B-W	2
S		2^{6}	12B-V	4 10
T		2^{7}	12B-U	8
U		2^{8}	13B-17	1
V		2^{9}	13B-18	2
W		2^{10}	13B-19	4 100
X	DATA IN	2^{11}	13B-20	8
Y				
Z	GND			

TITLE	DRAWING NO.
WIRE LIST - LOCATION 15B	0072

NO.	FUNCTION	FROM	NOTES
1	+5V		
2			
3	STROBE	21B-16	
4	ROT	15B-4	
5	GL_0 B_0 FB		WANG
6	GL_0 B_1 FB		↕
7	GL_0 B_2 FB		↕
8	GL_0 B_3 FB		WANG
9	WSTB 9		
10	MAN RST		(F. P. SWITCH)
11	I_0B_1		WANG
12			
13			
14			
15			
16			
17			
18			
19			
20			
21			
22	GND		
A	+5		
B			
C	DATENB	15B-C	
D	PROGRAM ERROR		
E	GL_0 A_0 FB		WANG
F	GL_0 A_1 FB		↕
H	GL_0 A_2 FB		↕
J	GL_0 A_3 FB		↕
K			↕
L	GKBD		↕
M	WSTB 28		WANG
N			
P			
R			
S			
T			
U			
V			
W			
X			
Y			
Z	GND		

TITLE	DRAWING NO.
WIRE LIST - LOCATION 16B	0071

NO.	FUNCTION		FROM	NOTES
1	+5V			
2				
3	STROBE		21B-16	
4	END		GROUND	
5	TAPE TRK	1		TO TAPE RCDR
6	↕	2		TO TAPE RCDR
7	↕	4		TO TAPE RCDR
8	TAPE TRK	8		TO TAPE RCDR
9	DATA IN	2^{12}	13B-X	
10	↑	2^{13}	13B-W	
11	↕	2^{14}	13B-V	
12	↕	2^{15}	13B-U	
13	↕	2^{16}	14B-17	
14	↕	2^{17}	14B-18	
15	↕	2^{18}	14B-19	
16	↕	2^{19}	14B-20	
17	↕	2^{20}	14B-X	
18	↕	2^{21}	14B-W	
19	↓	2^{22}	14B-V	
20	DATA IN	2^{23}	14B-U	
21				
22	GND			
A	+5V			
B				
C				
D	SYDET'			
E	STEP & RECORD			TO TAPE RCDR
F	TAPE TRK	A		TO TAPE RCDR
H	TAPE TRK	B		TO TAPE RCDR
J				
K	DATA IN	2^{0}	12B-17	
L	↑	2^{1}	12B-18	
M	↕	2^{2}	12B-19	
N	↕	2^{3}	12B-20	
P	↕	2^{4}	12B-X	
R	↕	2^{5}	12B-W	
S	↕	2^{6}	12B-V	
T	↕	2^{7}	12B-U	
U	↕	2^{8}	13B-17	
V	↕	2^{9}	13B-18	
W	↓	2^{10}	13B-19	
X	DATA IN	2^{11}	13B-20	
Y				
Z	GND			

TITLE	DRAWING NO.
WIRE LIST - LOCATION 17B	0077

NO.	FUNCTION		FROM	NOTES
1	+5V			
2				
3	DATA IN	2^3	6B-H	NAV 4
4	↑	2^2	6B-F	NAV 3
5	↓	2^1	6B-E	NAV 2
6	DATA IN	2^0	6B-D	NAV 1
7	REGISTER FULL			
8	Ø2		6B-16	
9				
10				
11				
12				
13				
14				
15				
16	REGISTER EMPTY			
17	DATA OUT	2^0		
18	↑	2^1		
19	↓	2^2		
20	DATA OUT	2^3		
21	-12V			
22				
A	+5V			
B				
C	DATA IN	2^4	6B-6	NAV 5
D	↑	2^5	6B-7	NAV 6
E	↓	2^6	GROUND	
F	DATA IN	2^7	GROUND	
H	READ IN		6B-J	READ INPUT NAV
J	Ø1		6B-17	
K				
L				
M				
N				
P				
R				
S				
T	SHIFT OUT		21B-H	SHIFT OUT NAV
U	DATA OUT	2^7		
V	↑	2^6		
W	↓	2^5		
X	DATA OUT	2^4		
Y	-12V			
Z				

TITLE	DRAWING NO.
WIRE LIST - LOCATION 18B	0108

NO.	FUNCTION		FROM	NOTES
1	+5V			
2				
3	DATA 1 STROBE		21B-6	VCO DATA GATE
4	DATA OUT	2^6		
5	↕	2^7		
6		2^8		
7		2^9		
8		2^{10}		
9	DATA OUT	2^{11}		
10	DATA IN	$B2^{11}$		
11	↕	$A2^{11}$		
12		$B2^{10}$		
13		$A2^{10}$		
14		$B2^9$		
15		$A2^9$		
16		$B2^8$		
17		$A2^8$		
18		$B2^7$		
19		$A2^7$		
20		$B2^6$	20B-4	
21	DATA IN	$A2^6$	17B-E	STEP & RECORD
22	GND			
A	+5V			
B				
C	DATA 2 STROBE		22B-H	NAV GATE
D	DATA OUT	2^5		
E	↕	2^4		
F		2^3		
H		2^2		
J		2^1		
K	DATA OUT	2^0		
L	DATA IN	$A2^0$	17B-5	TAPE TRK 1
M	↕	$B2^0$	20B-K	
N		$A2^1$	17B-6	TAPE TRK 2
P		$B2^1$	20B-J	
R		$A2^2$	17B-7	TAPE TRK 4
S		$B2^2$	20B-H	
T		$A2^3$	17B-8	TAPE TRK 8
U		$B2^3$	20B-F	
V		$A2^4$	17B-F	TAPE TRK A
W		$B2^4$	20B-E	
X	↕	$A2^5$	17B-H	TAPE TRK B
Y	DATA IN	$B2^5$	20B-D	
Z	GND			

TITLE	DRAWING NO.
WIRE LIST - LOCATION 19B	0107

NO.	FUNCTION		FROM	NOTES
1	+5V			
2				
3	DATA 1 STROBE		21B-F	NAV DATA GATE
4	DATA OUT	2^6		
5	↕	2^7		
6		2^8		
7		2^9		
8		2^{10}		
9	DATA OUT	2^{11}		
10	DATA IN	$B2^{11}$		
11	↕	$A2^{11}$		
12		$B2^{10}$		
13		$A2^{10}$		
14		$B2^9$		
15		$A2^9$		
16		$B2^8$		
17		$A2^8$		
18		$B2^7$		
19		$A2^7$		
20		$B2^6$	22B-T	ECD STEP
21	DATA IN	$A2^6$	21B-T	NAV STEP
22	GND			
A	+5V			
B				
C	DATA 2 STROBE		22B-S	TCD GATE
D	DATA OUT	2^5		
E	↕	2^4		
F		2^3		
H		2^2		
J		2^1		
K	DATA OUT	2^0		
L	DATA IN	$A2^0$	18B-17	
M	↕	$B2^0$	22B-6	CONT 1
N		$A2^1$	18B-18	
P		$B2^1$	22B-5	CONT 2
R		$A2^2$	18B-19	
S		$B2^2$	22B-4	CONT 4
T		$A2^3$	18B-20	
U		$B2^3$	22B-3	CONT 8
V		$A2^4$	18B-X	
W		$B2^4$	GROUND	
X	↕	$A2^5$	18B-W	
Y	DATA IN	$B2^5$	GROUND	
Z	GND			

TITLE	DRAWING NO.
WIRE LIST - LOCATION 20B	0107

NO.	FUNCTION	FROM	NOTES
1	+5V		
2			
3			
4	SY DET		FP 3 POSITION CONT. SW.
5			
6	VCO DATA GATE		
7	SHIFT OUT VCO		
8			
9	MEM CLR		FP MEM CLEAR SWITCH
10			
11	REGISTER EMPTY	18B-16	
12			
13			
14	10 kHz	1B-13	
15	SET PRIME		WIRED OR'D WITH FP PRIME
16	VCO STROBE		SW
17		14B-X	
18		14B-W	
19		14B-V	
20		14B-U	
21			
22	GND		
A	+5V		
B			
C			
D	PRIME	1T-13	
E			
F	NAV DATA GATE		
H	SHIFT OUT NAV		
J			
K			
L			
M			
N			
P			
R	1 kHz	1B-12	
S			
T	NAV STEP		
U			
V			
W			
X			
Y			
Z	GND		

TITLE	DRAWING NO.
WIRE LIST - LOCATION 21B	0109

NO.	FUNCTION		FROM	NOTES
1	+5V			
2				
3	CONT 8			
4	CONT 4			
5	CONT 2			
6	CONT 1			
7				
8				
9	X_1	1	23B-M	
10		2	23B-L	
11		4	23B-K	
12	$X10^0$	8	23B-J	
13	$X10^1$	1	23B-S	
14		2	23B-R	
15		4	23B-P	
16	$X10^1$	8	23B-N	
17	$X10^2$	1	23B-W	
18		2	23B-V	
19		4	23B-U	
20	$X10^2$	8	23B-T	
21				
22	GND			
A	+5V			
B				
C				
D				
E				
F	NAV DATA GATE		21B-F	
H	NAV GATE			
J				
K				
L				
M				
N				
P				
R	1 kHz		1B-12	
S	TCD GATE			
T	TCD STEP			
U	TCD CLEAR			
V				
W	IRG			
X				
Y				
Z	GND			

TITLE	DRAWING NO.
WIRE LIST - LOCATION 22B	0111

NO.	FUNCTION	FROM	NOTES
1	+5V		
2			
3	UP CONTROL	+5VDC	
4	CLOCK	4B-4	TCD STROBE
5	DOWN CONTROL	GROUND	
6	LOAD		
7	CLEAR	22B-U	TCD CLEAR
8	COUNTER LOAD 2^0		
9	2^1		
10	2^2		
11	2^3		
12	2^4		
13	2^5		
14	2^6		
15	2^7		
16	2^8		
17	2^9		
18	2^{10}		
19	COUNTER LOAD 2^{11}		
20	COUNTER OUT (12)		
21			
22	GND		
A	+5V		
B			
C			
D			
E			
F			
H			
J	COUNTER LOAD 2^3		
K	2^2		
L	2^1		
M	2^0		
N	2^7		
P	2^6		
R	2^5		
S	2^4		
T	2^{11}		
U	2^{10}		
V	2^9		
W	COUNTER LOAD 2^8		
X	COUNTER OUT (13)		
Y			
Z	GND		

TITLE	DRAWING NO.
WIRE LIST - LOCATION 23B	0112

NO.	FUNCTION	FROM	NOTES
1	+5V		
2			
3	UP CONTROL	4B-10	R+
4	CLOCK	4B-4	TCD STROBE
5	DOWN CONTROL	4B-11	R-
6	LOAD		F.P. RANGE LOAD SWITCH
7	CLEAR	GROUND	
8	COUNTER LOAD 2^0		
9	2^1		
10	2^2		
11	2^3		
12	2^4		
13	2^5		
14	2^6		
15	2^7		
16	2^8		
17	2^9		
18	2^{10}		
19	COUNTER LOAD 2^{11}		
20	COUNTER OUT (12)		
21			
22	GND		
A	+5V		
B			
C			
D			
E			
F			
H			
J	COUNTER OUT 2^3		8
K	2^2		4
L	2^1		2
M	2^0		1
N	2^7		80 ACCUMULATED
P	2^6		40
R	2^5		20 RANGE
S	2^4		10
T	2^{11}		800 INFORMATION
U	2^{10}		400
V	2^9		200
W	COUNTER OUT 2^8		100
X	COUNTER OUT (13)		
Y			
Z	GND		

TITLE	DRAWING NO.
WIRE LIST - LOCATION 24B	0112

NO.	FUNCTION	FROM	NOTES
1	+5V		
2			
3	UP CONTROL	4B-12	B+
4	CLOCK	4B-4	TCD STROBE
5	DOWN CONTROL	4B-13	B-
6	LOAD		F.P. BEARING LOAD SW
7	CLEAR	GROUND	
8	COUNTER LOAD 2^0		
9	2^1		
10	2^2		
11	2^3		
12	2^4		
13	2^5		
14	2^6		
15	2^7		
16	2^8		
17	2^9		
18	2^{10}		
19	COUNTER LOAD 2^{11}		
20	COUNTER OUT (12)		
21			
22	GND		
A	+5V		
B			
C			
D			
E			
F			
H			
J	COUNTER OUT 2^3		8
K	2^2		4
L	2^1		2
M	2^0		1
N	2^7		80 ACCUMULATED
P	2^6		40
R	2^5		20 BEARING
S	2^4		10
T	2^{11}		800 INFORMATION
U	2^{10}		400
V	2^9		200
W	COUNTER OUT 2^8		100
X	COUNTER OUT (13)		
Y			
Z	GND		

TITLE	DRAWING NO.
WIRE LIST - LOCATION 25B	0112

NO.	FUNCTION		FROM	NOTES
1	+5V			
2	LED ANODE	1st		LED'S (F.P.)
3	↑	2nd		↑
4	|	3rd		| CURRENT SOURCE
5	|	4th		|
6	↓	5th		↓
7	LED ANODE	6th		LED'S (F.P.)
8	LOAD A		1B-12	1 kHz
9	LOAD B		1B-12	1 kHz
10	DATA IN	2^{12}	24B-M	1
11	↑	2^{13}	24B-L	2
12	|	2^{14}	24B-K	4
13	|	2^{15}	24B-J	8
14	|	2^{16}	24B-S	10 ACCUMULATED
15	|	2^{17}	24B-R	20
16	|	2^{18}	24B-P	40 RANGE
17	|	2^{19}	24B-N	80
18	|	2^{20}	24B-W	100 INFORMATION
19	|	2^{21}	24B-V	200
20	↓	2^{22}	24B-U	400
21	DATA IN	2^{23}	24B-T	800
22	GND			
A	+5V			
B	SEGMENT	A		LED'S (F.P.)
C	↑	B		↑
D	|	C		|
E	|	D		| CURRENT SINK
F	|	E		|
H	↓	F		↓
J	SEGMENT	G		LED'S (F.P.)
K	LAMP TEST			F.P. SWITCH
L	DATA IN	2^{0}	25B-M	1
M	↑	2^{1}	25B-L	2
N	|	2^{2}	25B-K	4
P	|	2^{3}	25B-J	8
R	|	2^{4}	25B-S	10 ACCUMULATED
S	|	2^{5}	25B-R	20
T	|	2^{6}	25B-P	40 BEARING
U	|	2^{7}	25B-N	80
V	|	2^{8}	25B-W	100 INFORMATION
W	|	2^{9}	25B-V	200
X	↓	2^{10}	25B-U	400
Y	DATA IN	2^{11}	25B-T	800
Z	GND			

TITLE	DRAWING NO.
WIRE LIST - LOCATION 26B	0075

NO.	FUNCTION	FROM	NOTES
1	+5V		
2			
3	UP CONTROL		F.P FRONT/REAR WHEEL SEL
4	CLOCK	4B-4	TCD STROBE
5	DOWN CONTROL	GROUND	
6	LOAD		F.P. ODOMETER LOAD SW
7	CLEAR	GROUND	
8	COUNTER LOAD 2^0		
9	2^1		
10	2^2		
11	2^3		
12	2^4		
13	2^5		
14	2^6		
15	2^7		
16	2^8		
17	2^9		
18	2^{10}		
19	COUNTER LOAD 2^{11}		
20	COUNTER OUT (12)	28B-4	
21			
22	GND		
A	+5V		
B			
C			
D			
E			
F			
H			
J	COUNTER OUT 2^3		8
K	2^2		4
L	2^1		2
M	2^0		1
N	2^7		80 ACCUMULATED
P	2^6		40
R	2^5		20 RANGE
S	2^4		10
T	2^{11}		800 INFORMATION
U	2^{10}		400
V	2^9		200
W	COUNTER OUT 2^8		100
X	COUNTER OUT (13)		
Y			
Z	GND		

TITLE
WIRE LIST - LOCATION
27B

DRAWING NO.
0112

NO.	FUNCTION	FROM	NOTES
1	+5V		
2			
3	UP CONTROL		F.P.FRONT/REAR WHEEL SEL
4	CLOCK	27B-20	ODOMETER CARRY
5	DOWN CONTROL	GROUND	
6	LOAD		F.P. ODOMETER LOAD SW
7	CLEAR	GROUND	
8	COUNTER LOAD 2^0		
9	2^1		
10	2^2		
11	2^3		
12	2^4		
13	2^5		
14	2^6		
15	2^7		
16	2^8		
17	2^9		
18	2^{10}		
19	COUNTER LOAD 2^{11}		
20	COUNTER OUT (12)		
21			
22	GND		
A	+5V		
B			
C			
D			
E			
F			
H			
J	COUNTER OUT 2^3		8000
K	2^2		4000
L	2^1		2000
M	2^0		1000
N	2^7		80000 ACCUMULATED
P	2^6		40000 RANGE
R	2^5		20000 INFORMATION
S	2^4		10000
T	2^{11}		800000
U	2^{10}		400000
V	2^9		200000
W	COUNTER OUT 2^8		100000
X	COUNTER OUT (13)		
Y			
Z	GND		

TITLE	DRAWING NO.
WIRE LIST - LOCATION 28B	0075

NO.	FUNCTION		FROM	NOTES
1	+5V			
2	LED ANODE	1st		LED'S (F.P.)
3		2nd		
4		3rd		
5		4th		
6		5th		
7	LED ANODE	6th		LED'S (F.P.)
8	LOAD A		1B-12	1 kHz
9	LOAD B		1B-12	1 kHz
10	DATA IN	2^{12}	28B-M	1000
11		2^{13}	28B-L	2000
12		2^{14}	28B-K	4000
13		2^{15}	28B-J	8000 ACCUMULATED
14		2^{16}	28B-S	10000 ODOMETER
15		2^{17}	28B-R	20000
16		2^{18}	28B-P	40000
17		2^{19}	28B-N	80000
18		2^{20}	28B-W	100000
19		2^{21}	28B-V	200000
20		2^{22}	28B-U	400000
21	DATA IN	2^{23}	28B-T	800000
22	GND			
A	+5V			
B	SEGMENT	A		LED'S (F.P.)
C		B		
D		C		
E		D		
F		E		
H		F		
J	SEGMENT	G		LED'S (F.P.)
K	LAMP TEST			F.P. SWITCH
L	DATA IN	2^{0}	27B-M	1
M		2^{1}	27B-L	2
N		2^{2}	27B-K	4
P		2^{3}	27B-J	8
R		2^{4}	27B-S	10
S		2^{5}	27B-R	20
T		2^{6}	27B-P	40
U		2^{7}	27B-N	80
V		2^{8}	27B-W	100
W		2^{9}	27B-V	200
X		2^{10}	27B-U	400
Y	DATA IN	2^{11}	27B-T	800
Z	GND			

TITLE	DRAWING NO.
WIRE LIST - LOCATION 29B	0075

NO.	FUNCTION	FROM	NOTES
1	+5V		
2			
3	UP CONTROL	+5VDC	
4	CLOCK	18-10	10 Hz
5	DOWN CONTROL	GROUND	
6	LOAD		
7	CLEAR	GROUND	
8	COUNTER LOAD 2^0		
9	2^1		
10	2^2		
11	2^3		
12	2^4		
13	2^5		
14	2^6		
15	2^7		
16	2^8		
17	2^9		
18	2^{10}		
19	COUNTER LOAD 2^{11}		
20	COUNTER OUT (12)		
21			
22	GND		
A	+5V		
B			
C			
D			
E			
F			
H			
J	COUNTER OUT 2^3		8
K	2^2		4
L	2^1		2
M	2^0		1 ELAPSED TIME
N	2^7		80
P	2^6		40
R	2^5		20
S	2^4		10
T	2^{11}		800
U	2^{10}		400
V	2^9		200
W	COUNTER OUT 2^8		100
X	COUNTER OUT (13)		
Y			
Z	GND		

TITLE	DRAWING NO.
WIRE LIST - LOCATION 30B	0012

APPENDIX C

COMPONENT SPECIFICATIONS

Gates, Series 54/74

DM7400 (SN7400) quadruple two-input NAND gate
DM7410 (SN7410) triple three-input NAND gate
DM7420 (SN7420) dual four-input NAND gate

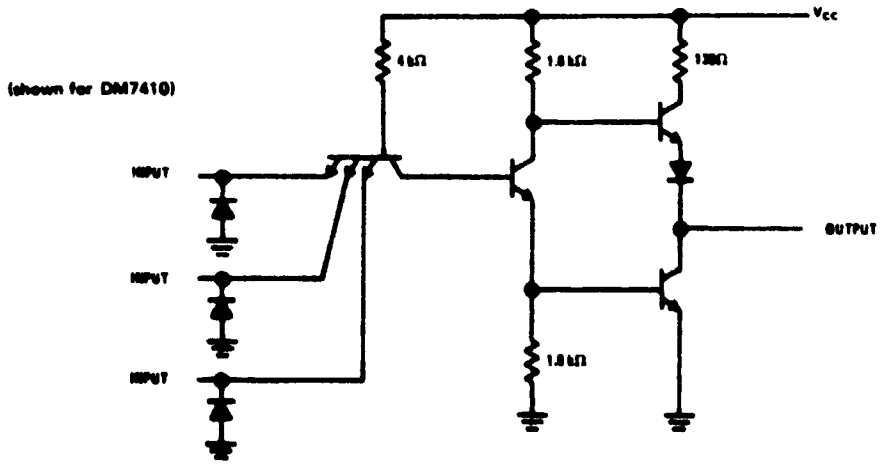
general description

Employing TTL (Transistor-Transistor-Logic) to achieve high speed at moderate power dissipation, these gates provide the basic functions used in the implementation of digital integrated circuit systems. Characteristics of the circuits include high noise immunity, low output impedance, good capacitive drive capability, and minimal variation in switching times with temperature. The gates are compatible with and interchangeable with Series 74 equivalent.

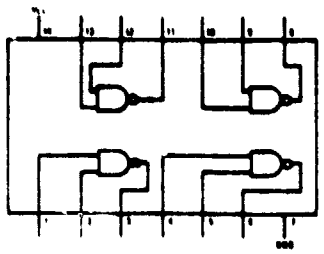
Key features include

- Typical Noise Immunity 1V
- Guaranteed Noise Immunity 400 mV
- Fan Out 10
- Allowable Power Supply Variation 4.75V to 5.25V
- Average Propagation Delay 13 ns
- Average Power Dissipation 10 mW per gate

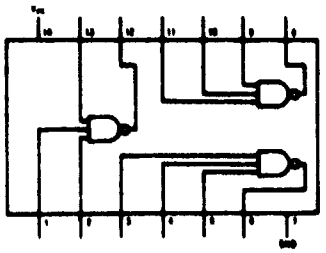
schematic and connection diagrams



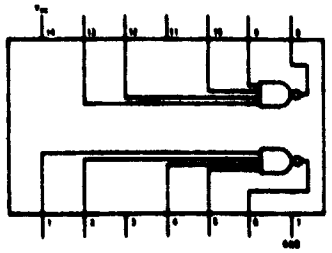
DM7400



DM7410



DM7420



Gates, Series 54/74

DM7430 (SN7430) eight-input gate

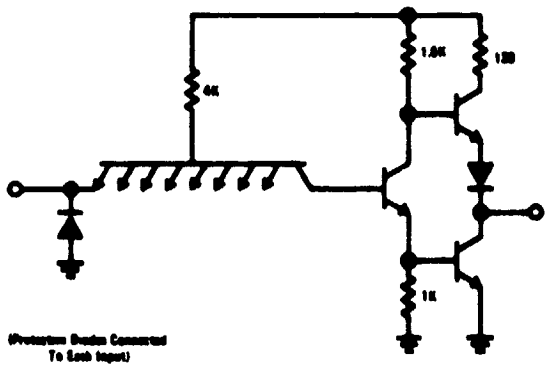
general description

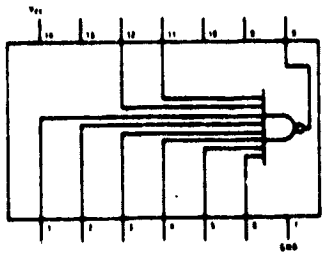
Employing TTL (Transistor-Transistor Logic) to achieve high speed at moderate power dissipation, the DM7430 provides the basic functions used in the implementation of digital integrated circuit systems. Characteristics of the circuit includes high noise immunity, low output impedance, good capacitive drive capability, and minimal variation in switching times with temperature. The DM7430 is compatible and interchangeable with Series 74.

Key features include:

- Typical Noise Immunity 1V
- Guaranteed Noise Immunity 400 mV
- Fan Out 10
- Allowable Power Supply Variation 4.75V to 5.25V
- Average Propagation Delay 13 ns
- Average Power Dissipation 10 mW per gate

schematic and connection diagrams





JUNE 1969

DM8040(SN7440) dual four input buffer

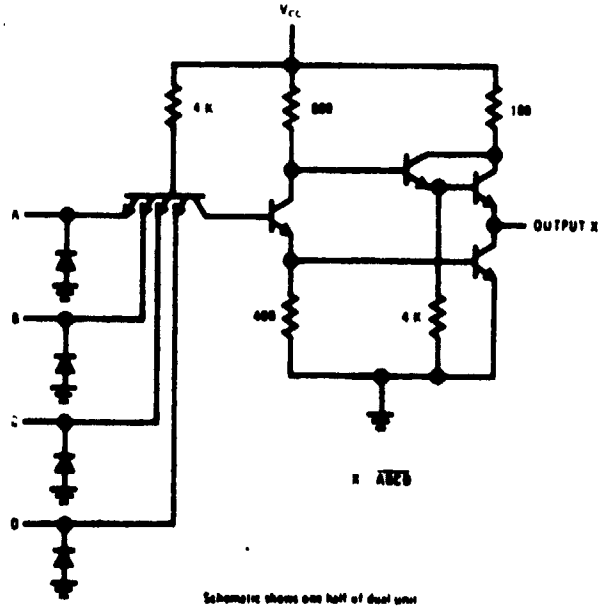
general description

Employing TTL (Transistor Transistor Logic) the DM8040 buffer is used when high fan out is desirable. In addition to driving a large number of TTL inputs, this buffer can be used to drive lines between equipments, to operate small relays and lamps (50 mA), and to act as a clock driver for synchronous logic systems. It is completely compatible with other Series 74 devices.

Key features include.

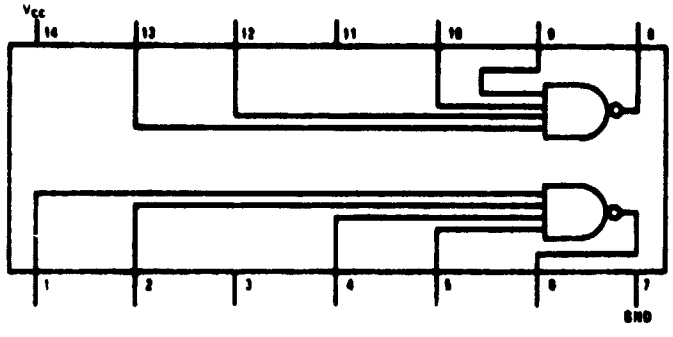
- Typical Noise Immunity 1V
- Guaranteed Noise Immunity 400 mV
- Fan Out 30
- Diode Clamps on Inputs

schematic diagram



Schematic shows one half of dual unit

connection diagram



Gates, Series 54/74

DM5402/DM7402 (SN5402/SN7402) quad two-input NOR gate

general description

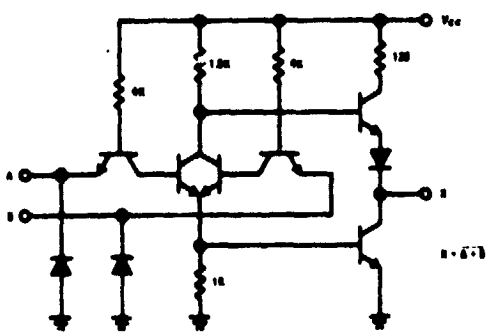
The DM5402/DM7402 is a quad 2-inout NOR gate utilizing TTL (Transistor-Transistor Logic) to achieve high speed at nominal power dissipation It is completely compatible with other Series 54/74 devices.

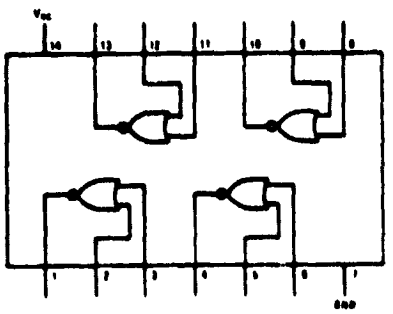
Features include.

- Input Clamping Diodes
- Typical Noise Immunity 1V
- Guaranteed Noise Immunity 400 mV
- Fan-out 10
- Allowable Power Supply Variation
  - DM5402 4 5V to 5 5V
  - DM7402 4.75V to 5.25V
- Average Propagation Delay 12 ns (with 50 pF)
- Average Power Dissipation 14 mW per gate

schematic and connection diagrams

DM5402/DM7402 (each gate)





JANUARY 1970

DM7004/DM8004 (SN5404/SN7404) hex inverter

general description

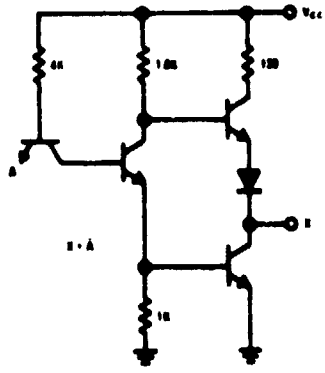
The DM7004/DM8004 is a hex inverter utilizing TTL to achieve high speed at nominal power dissipation. It is totally compatible with other Series 54/74 devices.

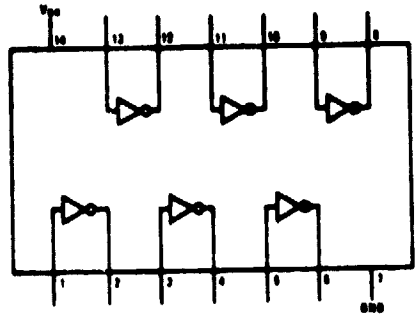
Features include:

- Input clamping diodes
- Typical Noise Immunity 1V
- Guaranteed Noise Immunity 400 mV
- Fan-out 10
- Allowable Power Supply Variation
  - DM7004 4.5V to 5.5V
  - DM8004 4.75V to 5.25V
- Average Propagation Delay 12 ns (with 50 pF)
- Average Power Dissipation 10 mW per gate

schematic and connection diagrams

DM7004/DM8004





© 1969 NATIONAL SEMICONDUCTOR CORP

DM5406/DM7406,DM5416/DM7416 (SN5406/SN7406,SN5416/SN7416) hex inverter buffers/drivers

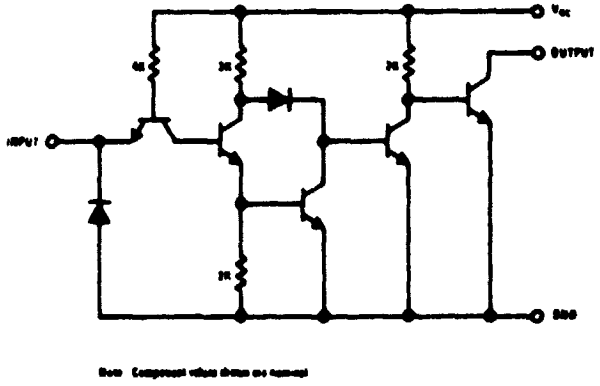
general description

These TTL hex inverter buffers/drivers are fully compatible for use with TTL and DTL logic circuits. Each inverter features high-voltage, open-collector outputs (DM5406/DM7406 30 volts minimum breakdown and DM5416/DM7416 15 volts minimum breakdown). These inverters also feature high sink current capability. (DM5406, DM5416 30 mA and DM7406, DM7416 40 mA).

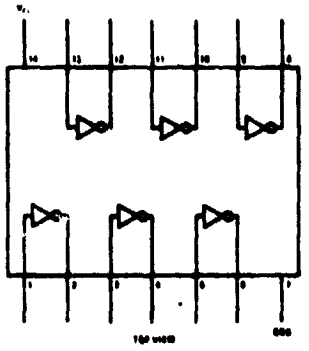
features

- Input clamp diodes
- High voltage open collector outputs
  - DM5406/DM7406 30V
  - DM5416/DM7416 15V
- High sink current capability
  - DM5406, DM5416 30 mA
  - DM7406, DM7416 40 mA
- 15 ns typical propagation delay time

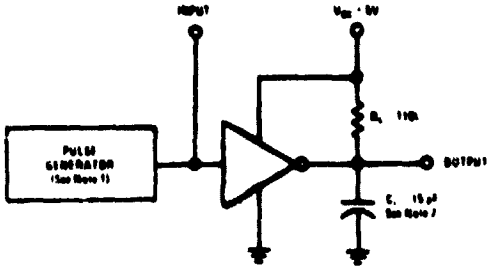
schematic and connection diagrams



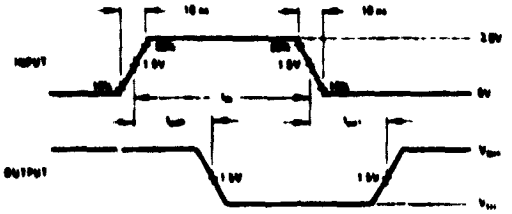
Dual-In-Line Package & Flat Package



ac test circuit



switching time waveforms



©1972 NATIONAL SEMICONDUCTOR CORP

DM5407/DM7407,DM5417/DM7417 (SN5407/SN7407,SN5417/SN7417) hex buffers/drivers

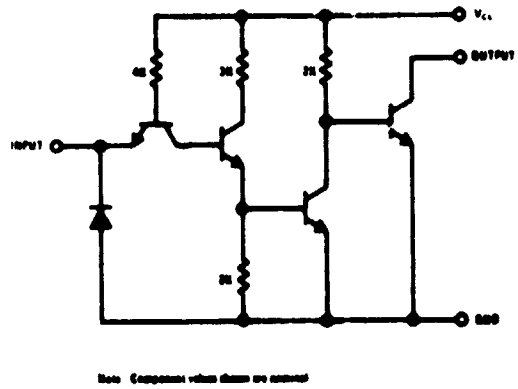
general description

These TTL hex buffers/drivers are fully compatible for use with TTL and DTL logic circuits. Each buffer features high-voltage, open collector outputs (DM5407/DM7407 30V minimum breakdown and DM5417/DM7417 15V minimum breakdown). These buffers also feature high sink current capability (DM5407, DM5417 30 mA and DM7407, DM7417 40 mA).

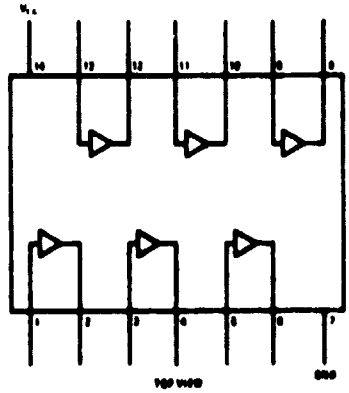
features

- Input clamp diodes
- High voltage open-collector outputs
  - DM5407/DM7407 30V
  - DM5417/DM7417 15V
- High sink current capability
  - DM5407,DM5417 30 mA
  - DM7407,DM7417 40 mA
- 14 ns typical propagation delay time
- 145 mW typical power dissipation

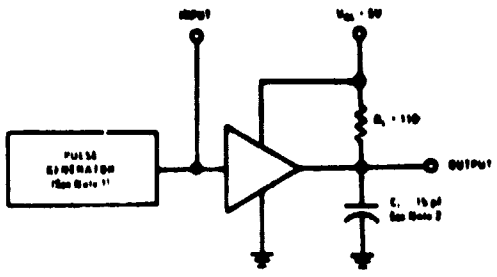
schematic and connection diagrams



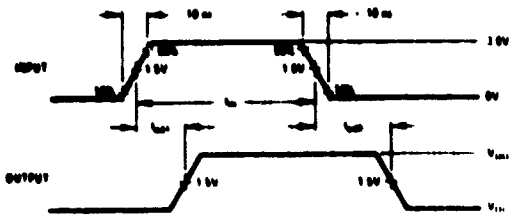
Dual In Line Package & Flat Package



ac test circuit



switching time waveforms



PRINTED IN U.S.A.

TTL MSI

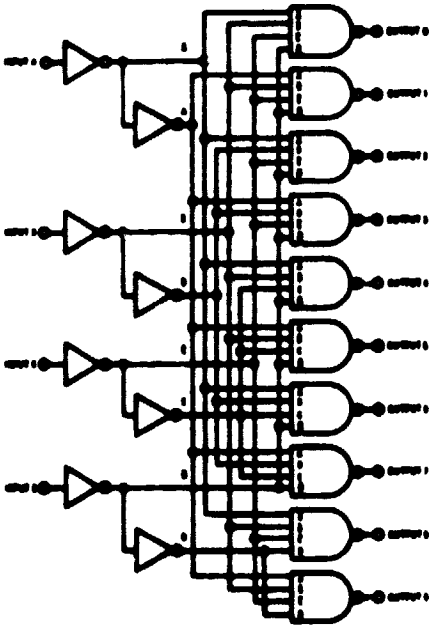
DM5442/DM7442 (SN5442/SN7442) BCD to decimal decoder

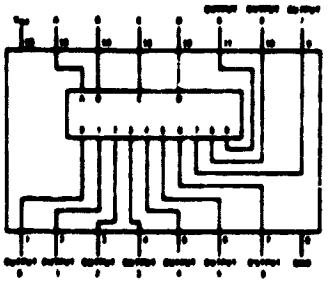
general description

The DM5442/DM7442 utilizes Series 54/74 compatible circuitry to decode a four-bit BCD number to one-of-ten decimal outputs. These ten decimal outputs are capable of driving 10 standard TTL loads each.

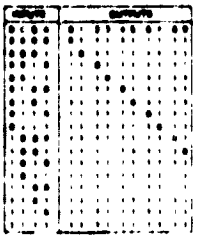
The decoding logic is designed such that when binary numbers between 10 and 15 are applied to the inputs, no outputs are enabled.

logic and connection diagrams

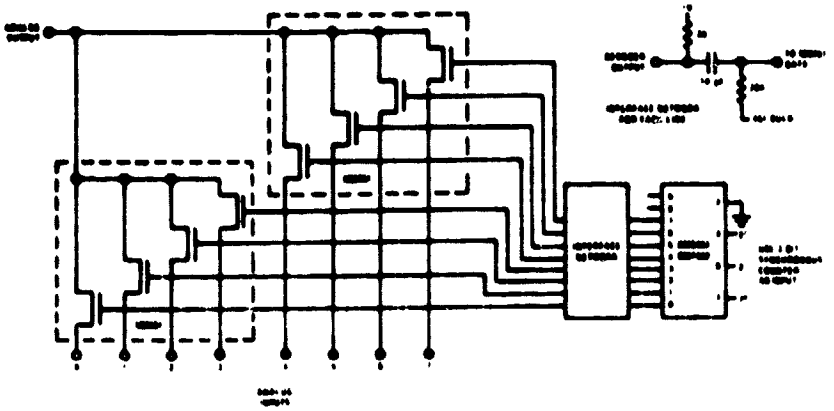




logic table



typical application



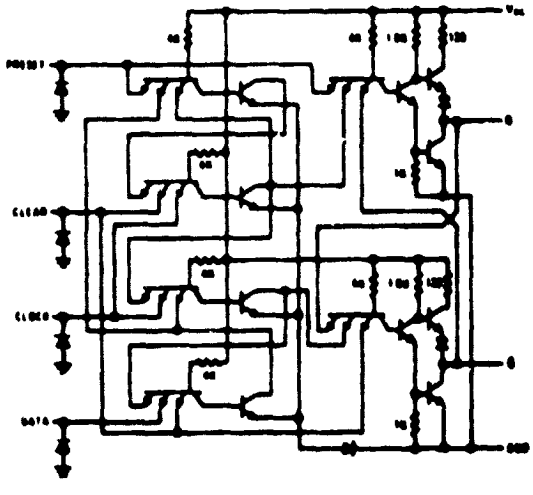
Flip Flops, Series 54/74

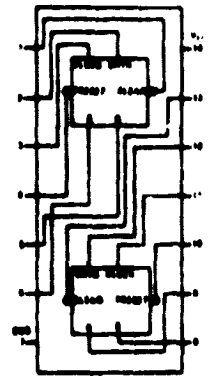
DM5474/DM7474 (SN5474/SN7474) dual D flip flops

general description

The DM5474/DM7474 dual D flip flops are designed for use where the flexibility of two inputs, such as on a JK or an RS flip flop, are not required. If only a single input (two logic combinations) can be utilized, then an extra input is superfluous. The DM5474/DM7474 have only a single DATA input. The logical level applied to this DATA input is transferred to the Q output when the clock pulse voltage rises to a logical 1. It is only necessary to set up information on the DATA input several nanoseconds before the clock pulse voltage rises, likewise it is only necessary to hold that information several nanoseconds after the clock pulse voltage reaches the logical 1 level. DATA information is then free to change in preparation for the next clock pulse. Since only one pin is used for data entry, fully asynchronous (both PRESET and CLEAR) capability can be provided in a 14 pin dual-in-line package.

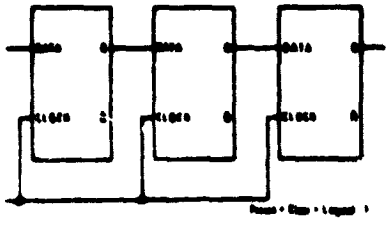
schematic and connection diagrams



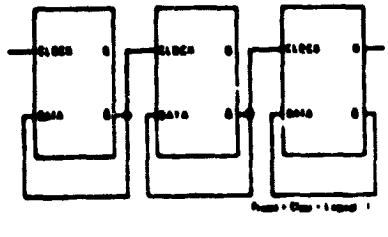


typical applications

shift register



ripple counter (divide-by-2^n)



TTL MSI

DM5475/DM7475 (SN5475/SN7475) quad latch

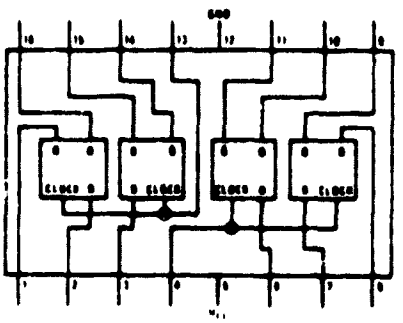
general description

The DM5475/DM7475 is a four bit storage element utilizing latch-connected gates to perform the memory function. TTL circuitry is employed providing fast speed and high noise immunity.

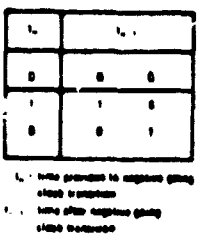
The information bits to be stored are applied to the D inputs. If the CLOCK input is in the logical 1 state, the Q output will follow the information applied to the corresponding D input. When the CLOCK is taken to the logical 0 state, whatever binary state was present on the D input at the time of this transition will be stored on the Q output. $\bar{Q}$ is also provided for added flexibility.

Two separate clock input lines are provided, each controlling two latches, so that other applications—such as a two-phase flip-flop—can be performed.

logic and connection diagram

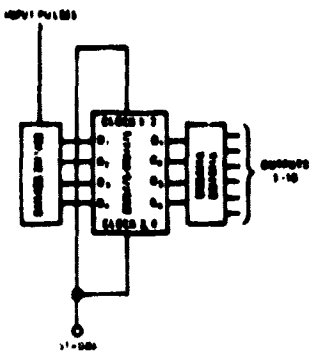


truth table

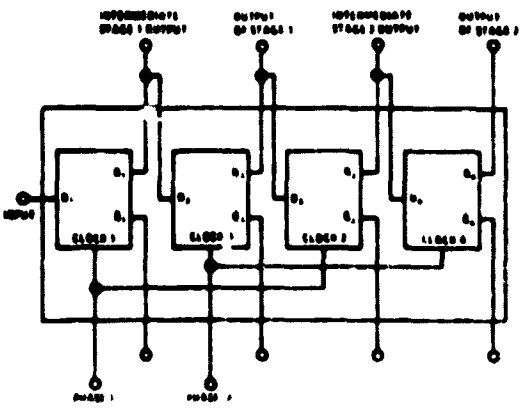


typical applications

Buffer Storage for Indicators



Dual Rank Shift Register



This announcement provides preliminary engineering information on new Texas Instruments products. Definitive specifications are now being prepared for publication.

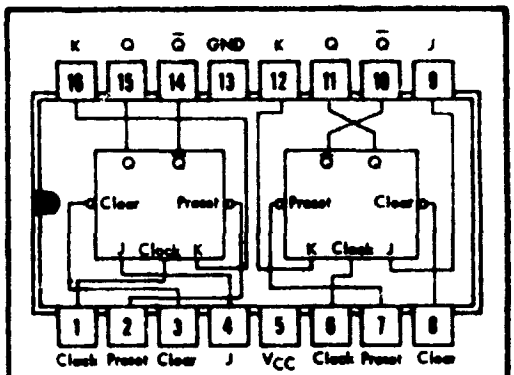
SOLID CIRCUIT®
SEMICONDUCTOR NETWORKS†

TYPE SN7476N
DUAL J-K MASTER-SLAVE FLIP-FLOP WITH PRESET AND CLEAR

logic

TRUTH TABLE		
t_n		t_{n+1}
J	K	Q
0	0	Q_n
0	1	0
1	0	1
1	1	$\overline{Q}_n$

NOTES: 1. t_n = Bit time before clock pulse.
2. t_{n+1} = Bit time after clock pulse



positive logic
Low input to preset sets Q to logical 1
Low input to clear sets Q to logical 0
Clear and preset are independent from clock

description

The SN7476N J-K flip-flop is based on the master-slave principle. Inputs to the master section are controlled by the clock pulse. The clock pulse also regulates the state of the coupling transistors which connect the master and slave sections. The sequence of operation is as follows (see figure 1):

1. Isolate slave from master
2. Enter information from J and K inputs to master
3. Disable J and K inputs
4. Transfer information from master to slave.

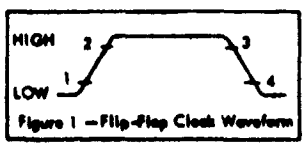


Figure 1 —Flip-Flop Clock Waveform

absolute maximum ratings over operating free-air temperature range (unless otherwise noted)

Supply Voltage, V_{CC} (See Note 1)	7 V
Input Voltage, V_{in} (See Notes 1 and 2)	5.5 V
Operating Free-Air Temperature Range	0°C to 70°C
Storage Temperature Range	-55°C to 125°C

NOTES: 1. Voltage values are with respect to network ground terminal
2. Input signals must be zero or positive with respect to network ground terminal.

SC-9889
January, 1967

†Patented by Texas Instruments

nstruments reserves the right to make
s at any time in order to improve de-
d to supply the best product possible.

TEXAS INSTRUMENTS
INCORPORATED
SEMICONDUCTOR-COMPONENTS DIVISION
POST OFFICE BOX 5012 • DALLAS 22, TEXAS

PRINTED IN U.S.A.

DM5490/DM7490 (SN5490/SN7490) decade counter
DM5492/DM7492 (SN5492/SN7492) divide-by-twelve counter
DM5493/DM7493 (SN5493/SN7493) four-bit binary counter

general description

These TTL (Transistor-Transistor-Logic) monolithic counters are capable of counting pulses at a guaranteed frequency of 20 MHz. Gating is provided to reset the counters to the more popular states. Characteristics include high speed at moderate power dissipation, high noise immunity, and minimal variation in performance over temperature. These circuits are completely compatible with other series 54/74 devices.

To provide greater flexibility, the counters may be used in any of the modes as follows:

DM5490/DM7490

1. BCD decade counter—connect the A output to the BD input. This is the normal mode of operation.
2. Symmetrical divide-by-ten operation—connect the D output to the A input. When pulses are then applied to the BD input, a symmetrical waveform one tenth of the applied frequency will appear at the A output.
3. Divide-by-five operation—if no external connections are made a frequency division of five will result between the BD input and the D output. This allows the flip flop A to be used to divide-by-two if desired.

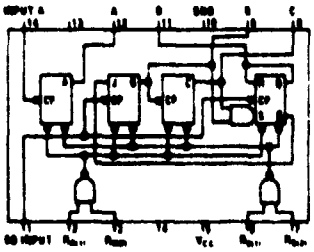
DM5492/DM7492

1. When used as a divide-by-twelve counter output A is connected to the BC input. In this mode outputs A, C, and D provide divisions by 2, 6, and 12 respectively.
2. When the connection is not made between A and BC, and when an input frequency is applied to the BC input, a frequency division of 3 and 6 results on the C and D outputs respectively. In this mode the A flip flop may be used independently except for the common reset input.

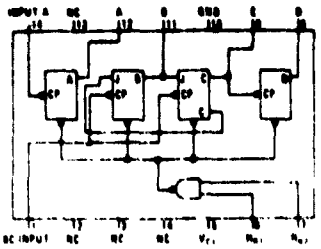
DM5493/DM7493

1. When used as a four-bit binary counter, output A is connected to the B input. In this mode outputs A, B, C, and D provide divisions by 2, 4, 8, and 16 respectively.
2. When the connection is not made between A and B and when an input frequency is applied to the B input, a frequency division of 2, 4 and 8 results on the B, C, and D outputs respectively. In this mode the A flip flop may be used independently except for the common reset input.

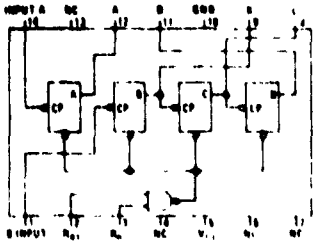
logic and connection diagrams



DM5490/DM7490



DM5492/DM7492



DM5493/DM7493

TTL MSI

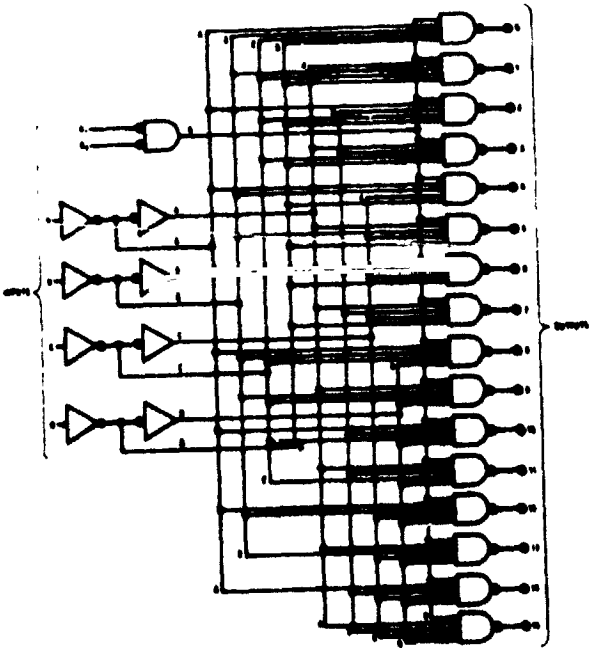
DM54154/DM74154 (SN54154/SN74154)
4-line-to-16-line decoder/demultiplexer

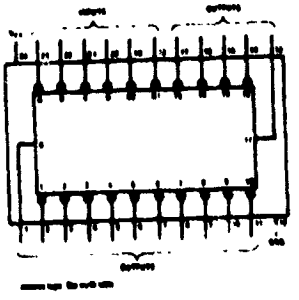
general description

The DM54154/DM74154 is a TTL monolithic 4-line-to-16-line decoder which allows decoding of a 4 bit binary coded input into one of 16 separate outputs. The device is provided with two strobe lines, both of which have to be in the low state in order to perform the decoding function; if either of the strobes is high, all 16 outputs will remain high. The device can be used as a demultiplexer by passing information from one of the strobes (the other being low) to an output selected by the 4 line input address. Other device features include:

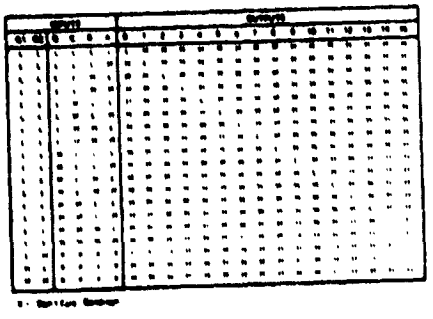
- Equivalent to Fairchild's 9311-51/9311-59 and Texas Instruments' SN54154/SN74154
- All inputs contain clamp diodes
- Unit performs as a one line to 16 line demultiplexer
- Unit performs as a decoder of a 4 bit binary input to 1 of 16 outputs
- Typical propagation delay is 20 ns from inputs and 17 ns from strobe

logic and connection diagrams





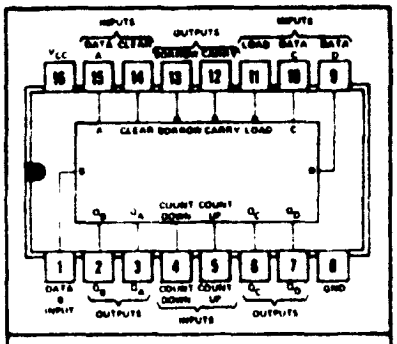
truth table



CIRCUIT TYPES SN54192, SN54193, SN74192, SN74193
SYNCHRONOUS 4-BIT UP/DOWN COUNTERS (DUAL CLOCK WITH CLEAR)

- Cascading Circuitry Provided Internally
- Synchronous Operation
- Individual Preset to Each Flip-Flop
- Fully Independent Clear Input
- Typical Maximum Input Count Frequency . . . 32 MHz

J OR N
DUAL-IN-LINE PACKAGE (TOP VIEW)



logic: Low input to load sets Q_A = A, Q_B = B, Q_C = C, and Q_D = D

description

These monolithic circuits are synchronous reversible (up/down) counters having a complexity of 55 equivalent gates. The SN54192 and SN74192 are BCD counters and the SN54193 and SN74193 are 4-bit binary counters. Synchronous operation is provided by having all flip flops clocked simultaneously so that the outputs change coincidently with each other when so instructed by the steering logic. This mode of operation eliminates the output counting spikes which are normally associated with asynchronous (ripple-clock) counters.

The outputs of the four master-slave flip-flops are triggered by a low to high-level transition of either count (clock) input. The direction of counting is determined by which count input is pulsed while the other count input is high.

All four counters are fully programmable, that is, the outputs may be preset to any state by entering the desired data at the data inputs while the load input is low. The output will change to agree with the data inputs independently of the count pulses. This feature allows the counters to be used as modulo-N dividers by simply modifying the count length with the preset inputs.

A clear input has been provided which forces all outputs to the low level when a high level is applied. The clear function is independent of the count and load inputs. An input buffer has been placed on the clear, count, and load inputs to lower the drive requirements to one normalized Series 54/74 load. This is important when the output of the driving circuitry is somewhat limited.

These counters were designed to be cascaded without the need for external circuitry. Both borrow and carry outputs are available to cascade both the up- and down-counting functions. The borrow output produces a pulse equal in width to the count-down input when the counter underflows. Similarly, the carry output produces a pulse equal in width to the count-up input when an overflow condition exists. The counters can then be easily cascaded by feeding the borrow and carry outputs to the count-down and count-up inputs respectively of the succeeding counter.

Power dissipation is typically 325 milliwatts for either the decade or binary version. Maximum input count frequency is typically 32 megahertz and is guaranteed to be 25 MHz minimum. All inputs are buffered and represent only one normalized Series 54/74 load. Input clamping diodes are provided to minimize transmission line effects and thereby simplify system design. The SN54192 and SN54193 are characterized for operation over the full military temperature range of −55°C to 125°C, the SN74192 and SN74193 are characterized for operation from 0°C to 70°C.

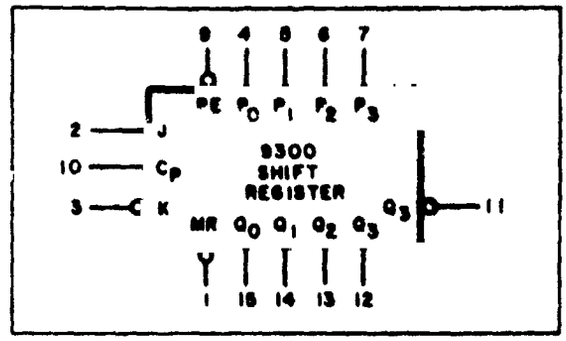
absolute maximum ratings over operating free-air temperature range (unless otherwise noted)

Supply voltage V_{CC} (see Note 1)		7 V
Input voltage (see Note 1)		5.5 V
Operating free-air temperature range	SN54192 and SN54193 Circuits	−55°C to 125°C
	SN74192 and SN74193 Circuits	0°C to 70°C
Storage temperature range		−65°C to 150°C

NOTE 1: Voltage values are with respect to network ground terminal.

9300
4 - Bit Shift Register

LOGIC DIAGRAM



V_{CC} = Pin 14
Gnd = Pin 8

PIN NOMENCLATURE

$\overline{PE}$	Parallel Enable (Active Low) Input
P_0, P_1, P_2, P_3	Parallel Inputs
J	First Stage J (Active High) Input
$\overline{K}$	First Stage K (Active Low) Input
C_p	Clock Active High Going Edge Input
$\overline{MR}$	Master Reset (Active High) Input
Q_0, Q_1, Q_2, Q_3	Parallel Outputs
$\overline{Q_3}$	Complementary Last Stage Output

Data entry is synchronous with the registers changing state after each low to high transition of the clock. With the parallel enable low the parallel inputs determine the next condition of the shift register. When the parallel enable input is high the shift register performs a one bit shift to the right, with data entering the first stage flip-flop through $J\overline{K}$ inputs. By tying the two inputs together D type entry is obtained.

The asynchronous active low master reset when activated overrides all other input conditions and clears the register.

TRUTH TABLE FOR SERIAL ENTRY

J	$\overline{K}$	Q_o at t_{n+1}
L	L	L
L	H	Q_o at t_n (no change)
H	L	$\overline{Q}_o$ at t_n (toggles)
H	H	H

$\overline{PE}$ = HIGH, $\overline{MR}$ = HIGH (n + 1) indicates state after next clock

DM9301/DM8301 BCD-to-decimal decoder

general description

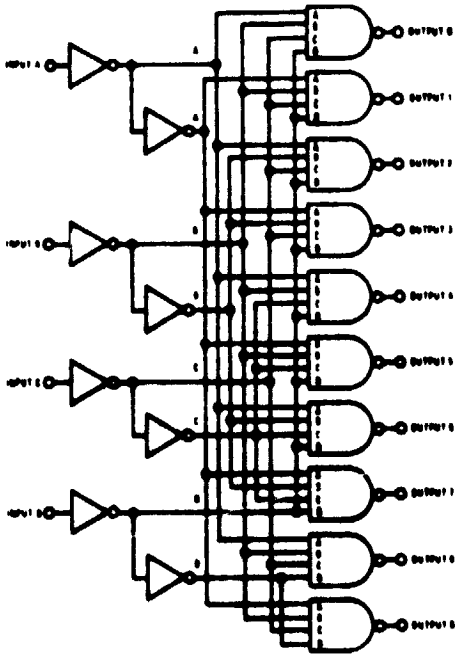
The DM9301/DM8301 utilizes Series 54/74 compatible circuitry to decode a four-bit BCD number to one-of-ten decimal outputs. These ten decimal outputs are capable of driving 10 standard TTL loads each.

The decoding logic is designed such that when binary numbers between 10 and 15 are applied to the inputs, no outputs are enabled.

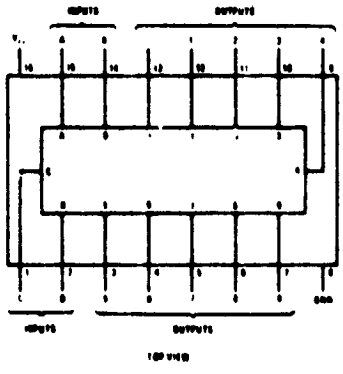
features

- 125 mW typical power dissipation
- 20 ns typical propagation delay
- Clamp diodes on inputs

logic and connection diagrams



Dual-In-Line Package



logic table

INPUTS				OUTPUTS								
D	C	B	A	0	1	2	3	4	5	6	7	8	9
0	0	0	0	0	1	1	1	1	1	1	1	1	1
0	0	0	1	1	0	1	1	1	1	1	1	1	1
0	0	1	0	1	1	0	1	1	1	1	1	1	1
0	0	1	1	1	1	1	0	1	1	1	1	1	1
0	1	0	0	1	1	1	1	0	1	1	1	1	1
0	1	0	1	1	1	1	1	1	0	1	1	1	1
0	1	1	0	1	1	1	1	1	1	0	1	1	1
0	1	1	1	1	1	1	1	1	1	1	0	1	1
1	0	0	0	1	1	1	1	1	1	1	1	0	1
1	0	0	1	1	1	1	1	1	1	1	1	1	0
1	0	1	0	1	1	1	1	1	1	1	1	1	1
1	0	1	1	1	1	1	1	1	1	1	1	1	1
1	1	0	0	1	1	1	1	1	1	1	1	1	1
1	1	0	1	1	1	1	1	1	1	1	1	1	1
1	1	1	0	1	1	1	1	1	1	1	1	1	1
1	1	1	1	1	1	1	1	1	1	1	1	1	1

REPRODUCIBILITY OF THE
ORIGINAL PAGE IS POOR

MAY 1970

DM7850/DM8850(9601)
retriggerable monostable multivibrator

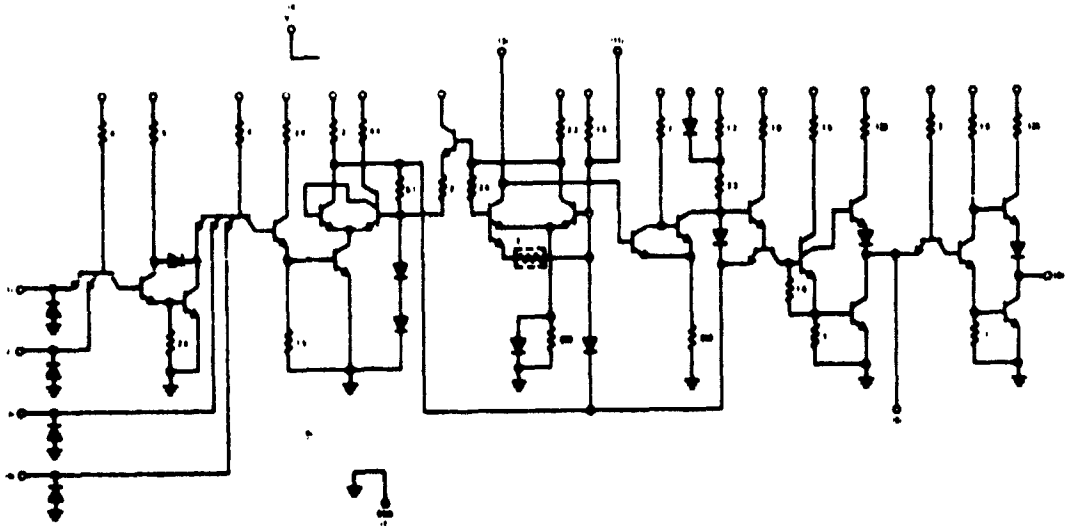
general description

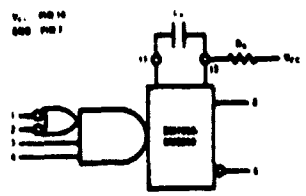
The DM7850/DM8850 is both pin-for-pin and spec-for-spec interchangeable with the 9601 one-shot. Pulse widths range from 50 ns upward depending upon the values of the external R&C used. The retriggerable feature allows for output pulse widths to be extended beyond the normal range attainable with just a resistor and capacitor.

features

- Input Clamping Diodes
- Complementary DC Level Sensitive Inputs
- Flexibility of Operation- Optional Retriggering/Lockout Capability
- DTL/TTL Compatible Logic Levels
- High Speed Operation—Input Repetition Rate > 10 MHz
- Output Pulse Width Range 50 ns to ∞
- Leading or Trailing Edge Triggering
- Complementary Outputs

schematic and logic diagrams





© 1970 NATIONAL SEMICONDUCTOR CORP

PRINTED IN U.S.A.

TTL MSI

DM7200/DM8200 four bit comparator

general description

The DM7200/DM8200 is a monolithic TTL (Transistor-Transistor Logic) circuit which is used to compare the numerical values of two four-bit binary numbers. Outputs indicate (1) whether number A is greater than number B, (2) whether number B is greater than number A, or (3) whether the two numbers are equal. A strobe input overrides all other inputs and places the outputs in a definite state. The design chosen provides maximum speed with minimum circuit complexity. Numerical comparisons of words longer than four bits may be made by using additional DM7200/DM8200's only.

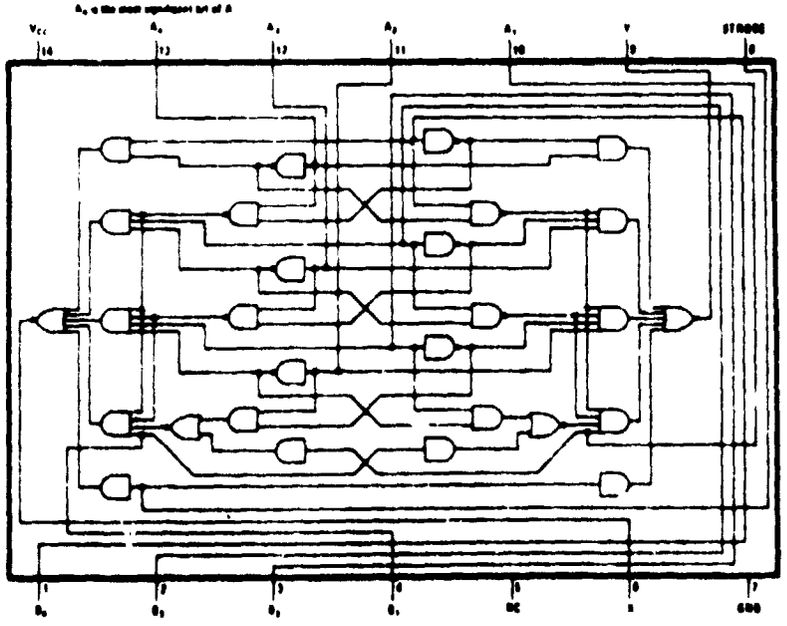
Features Include

- Series 54/74 Compatible
- Typical Noise Immunity 1V
- Guaranteed Noise Immunity 400 mV
- Typical Propagation Delay 20 ns
- Typical Power Dissipation 175 mW

The DM7200/DM8200 has applications in:

- Digital stepping-motor control applications
- Convergence applications
- Summing junction for digital servo systems

logic and connection diagram



logic table

Input			Output	
Number $A_4A_3A_2A_1$	Number $B_4B_3B_2B_1$	Strobe	X	Y
A	B	0	1	0
A	B	0	0	1
A	B	0	1	1
A	B	1	0	0

Tri-State Logic

DM7551/DM8551 tri-state quad-D flip flop

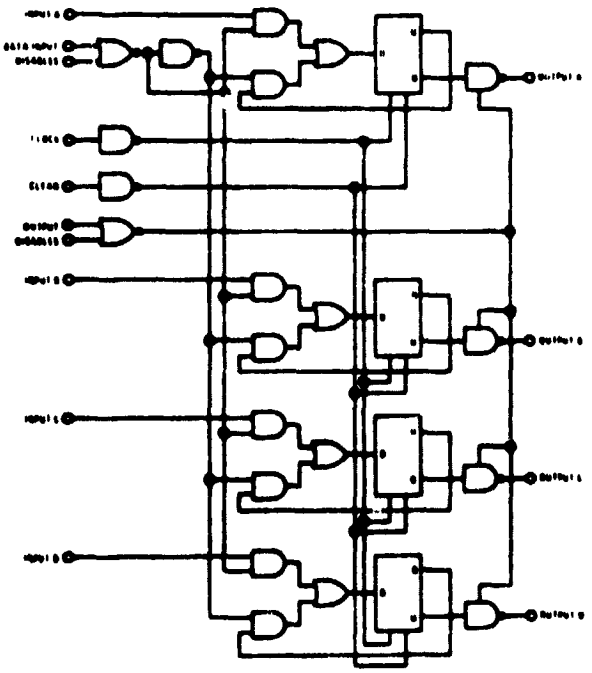
general description

The DM7551/DM8551 is a tri-state logic device which provides four D-type flip flops in one package which operate synchronously from a common clock. Features of the device are

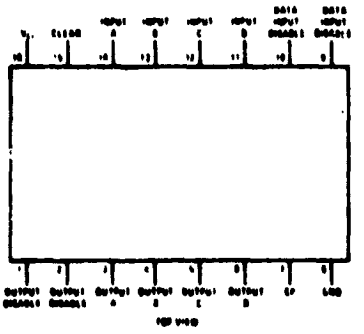
- Series 54/74 compatible
- 23 ns typical propagation delay
- 260 mW typical power dissipation
- Outputs directly connectable for bus line operation
- A "do-nothing" state accomplished without gating the clock
- Simple disable encoding

A unique three-state output allows the device to be used in bus-organized systems. The outputs can be directly wired to outputs of other DM7551/DM8551's without encountering the problems normally met with "collector-ORing" TTL circuits. This is accomplished by gating the normally low impedance logical "1" or logical "0" output into a high impedance state.

logic and connection diagrams



Dual-In-Line Package



TRUTH TABLE (Both Output Disables Low)

t_n		t_{n+1}
DATA INPUT DISABLE	DATA INPUT	OUTPUT
Logical "1" on 1 or both inputs	X	O_n
Logical "0" on both inputs	1	1
Logical "0" on both inputs	0	0

X = Don't Care

TTL MSI

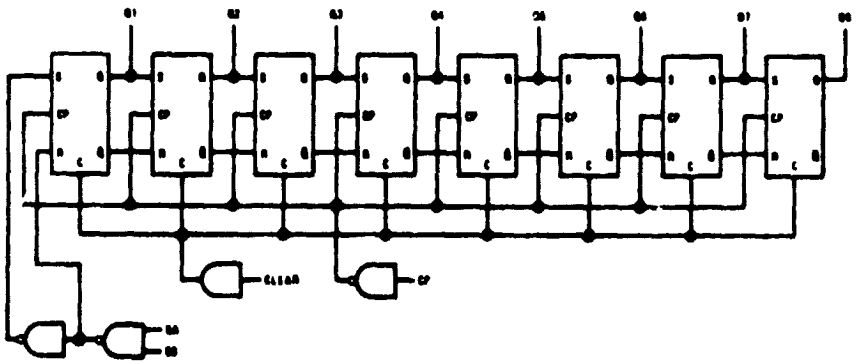
DM7570/DM8570 eight bit serial-in parallel-out shift register

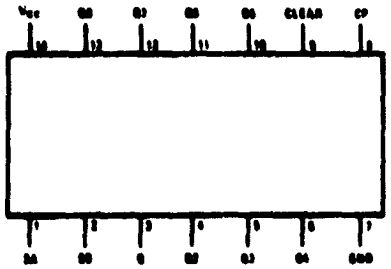
general description

The DM7570/DM8570 utilizes Series 54/74 compatible TTL circuitry to provide an eight bit serial in parallel-out shift register designed to operate at frequencies of 20 MHz. Other features include gated serial inputs for strobe capability and a clear input which, when taken to a logical 0, asynchronously sets all flip flops to the logical 0 state.

Because the flip flops are R S instead of J K, input information may be changed immediately prior to the triggering edge of the clock waveform. Logical 1 levels on SA and SB enter logical 1's into the shift register. Clocking occurs on the positive going edge of the clock pulse.

logic and connection diagrams

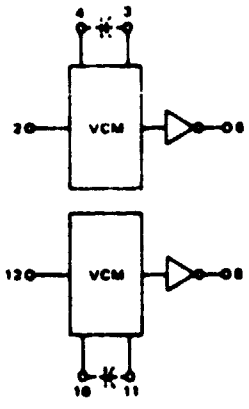




DUAL
VOLTAGE-CONTROLLED
MULTIVIBRATOR

MC4324F, L*
MC4024F, L, P*

Compatible with all MTTL and MDTL families



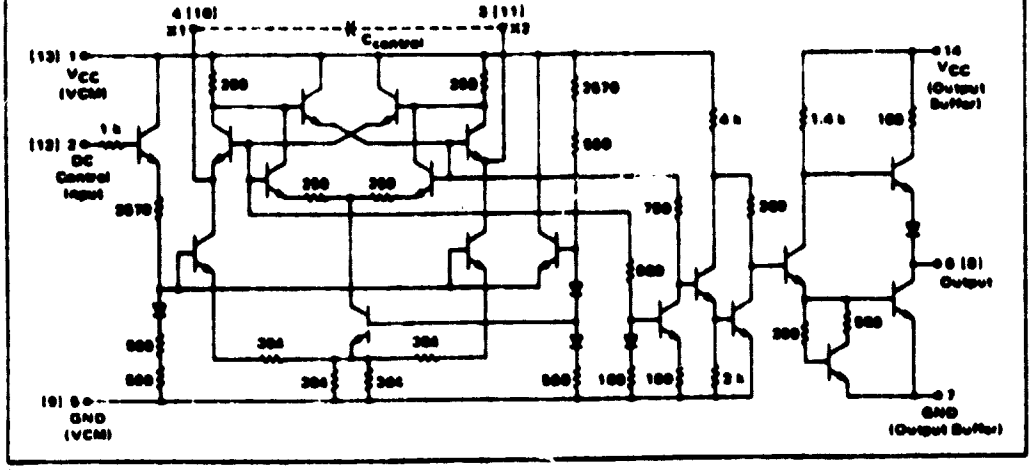
The MC4324/4024 voltage-controlled multivibrator provides appropriate level shifting to produce an output compatible with MTTL logic levels. Frequency control is accomplished through the use of voltage-variable current sources which control the slew rate of a single capacitor. Variation of the output frequency over a 3.5 to 1 range is possible with an input dc control voltage of +1.0 to +5.0 volts.

Voltage-controlled multivibrators are used in phase-locked loops for digital frequency control. They may also be used for some types of A to D converters.

V_{CC} VCM = 1, 13
Output Buffer = 14
GND VCM = 5, 9
Output Buffer = 7
External Capacitor for Frequency Range Determination
Output Loading Factor = 7
Power Dissipation = 160 mW typ/pkg
Maximum Operating Frequency = 30 MHz typ

CIRCUIT SCHEMATIC

1/2 OF CIRCUIT SHOWN
(Numbers in brackets are pin numbers for other half.)

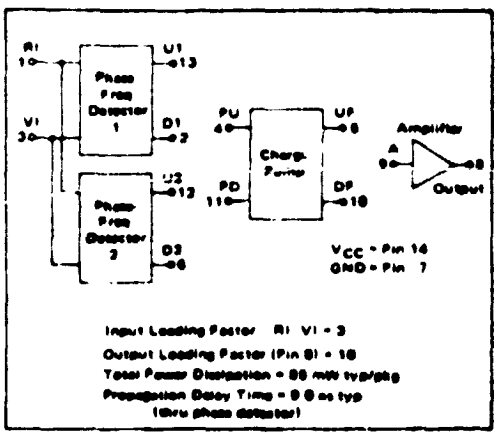


*P suffix = TO 88 ceramic flat package (Case 607)
L suffix = TO 116 ceramic dual in-line package (Case 632)
P suffix = TO 116 plastic dual in-line package (Case 646).

PHASE-FREQUENCY DETECTOR

MC4344F, L*
MC4044F, L, P*

Compatible with all MTTL and MDTL families



Input Loading Factor RI VI = 3

Output Loading Factor (Pin 8) = 10

Total Power Dissipation = 85 mW typ/pkg

Propagation Delay Time = 9.0 ns typ (thru phase detector)

This device contains two digital phase detectors and a charge pump circuit which converts MTTL inputs to a dc voltage level for use in frequency discrimination and phase-locked-loop applications.

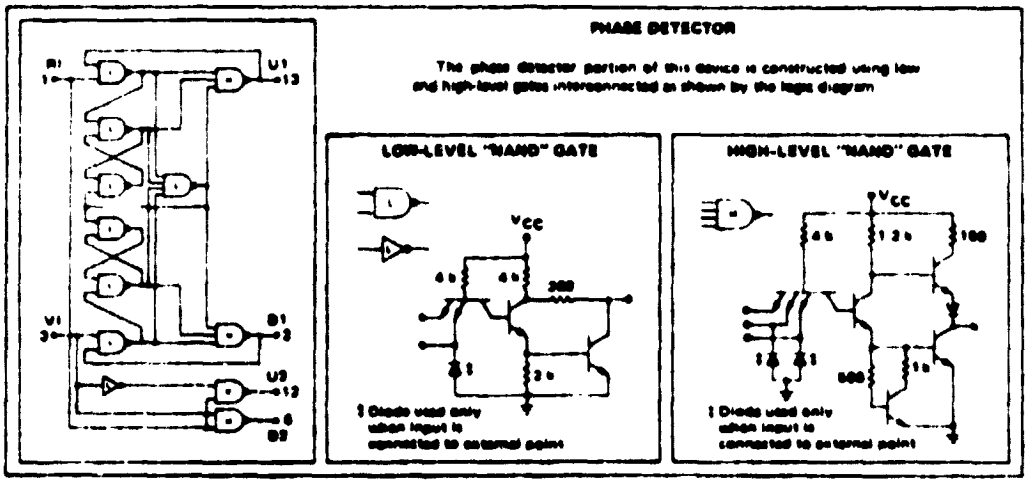
The two phase detectors have common inputs. Phase-frequency detector 1 is locked in (indicated by both outputs high) when the negative transitions of the variable input (VI) and reference input (RI) are equal in frequency and phase. If the variable input is lower in frequency or lags in phase, the U1 (up) output goes low; conversely the D1 (down) output goes low when the variable input is higher in frequency or leads the reference input in phase. It is important to note that the duty cycles of the variable input and the reference input are not important since negative transitions control system operations.

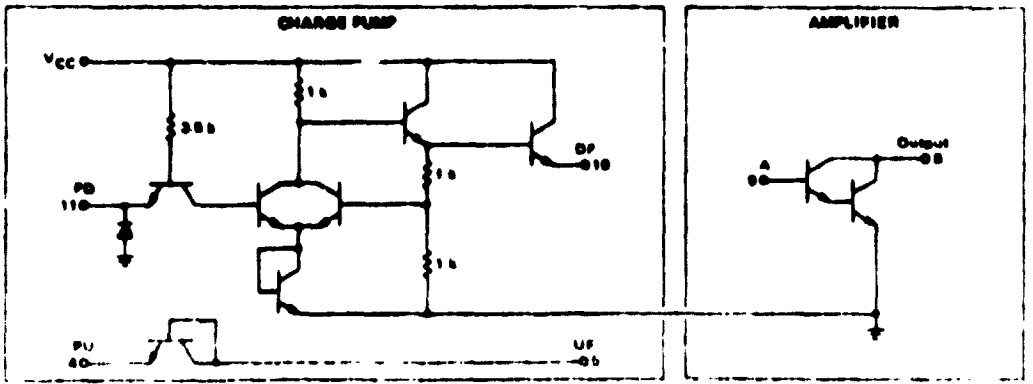
Phase detector 2, on the other hand, is locked in when the variable input phase lags the reference phase by 90° (indicated by the U2 and D2 outputs alternately going low with equal pulse widths). If the variable input phase lags by more than 90° U2 will remain low longer than D2 and, conversely, if the variable input phase lags the reference phase by less than 90°, D2 remains low longer. In this phase detector the variable input and the reference input must have 50% duty cycles.

The charge pump accepts the phase detector outputs (U1 or U2 applied to PU, and D1 or D2 applied to PD) and converts them to fixed amplitude positive and negative pulses at the UP and DP outputs respectively. These pulses are applied to a log-lead active filter, which incorporates external components, as well as the amplifier provided in the MC4344/4044 circuit. The filter provides a dc voltage proportional to the phase error.

PHASE DETECTOR

The phase detector portion of this device is constructed using low and high-level gates interconnected as shown by the logic diagram.





* Suffix = TO-86 ceramic flat package (Case 607)
L Suffix = TO-116 ceramic dual-in-line package (Case 632)
P Suffix = TO-116 plastic dual-in-line package (Case 648)

REPRODUCIBILITY OF THE ORIGINAL PAGE IS POOR

SIGNETICS DCL INTEGRATED CIRCUITS

8440 DUAL AND-OR-INVERT GATE

The 8440 Dual AND-OR-INVERT Gate implements the Exclusive-OR function.

The active output structure of the 8440 provides high AC noise immunity due to its low output impedance in both the "1" and "0" output states.

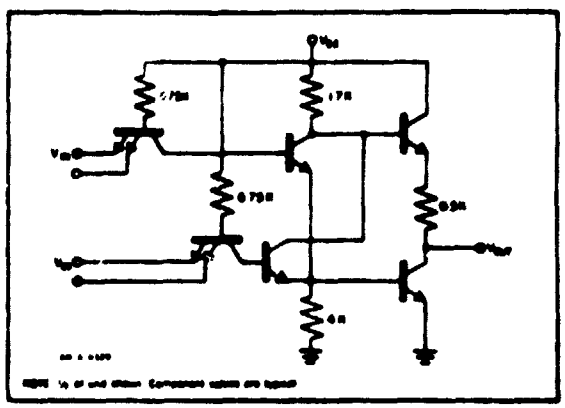
Output short circuit protection is provided by a current limiting resistor.

Values chosen for the collector and emitter resistors of the phase-splitter transistor ensure optimum on-off relationships of the totem-pole output pair.

General areas of application for the 8440 include half and full adders, digital comparators, and AND-OR control logic for inputs to binary clock steering lines.

Section 4 of this handbook contains helpful applications information and usage rules for the 8440.

BASIC CIRCUIT SCHEMATIC



ELECTRICAL CHARACTERISTICS (NOTES: 1, 2, 3, 4, 5, 6, 14)

ACCEPTANCE TEST SUB-GROUP	CHARACTERISTIC	LIMITS				TEST CONDITIONS						
		MIN.	TYP.	MAX.	UNITS	TEMP [illegible]	TEMP [illegible]	V_{cc}	OBSERVED [illegible]	OTHER INPUTS	OUTPUTS	NOTES
A-1	"1" OUTPUT VOLTAGE	3.6			V	+55°C	0°C	4.75V	0.1V		-330µA	8
A-2		3.6			V	+25°C	+25°C	5.0V	0.1V		-330µA	8
A-4		3.4			V	+125°C	+75°C	4.75V	0.1V		-330µA	8
A-1	"0" OUTPUT VOLTAGE			0.35	V	-55°C	0°C	4.75V	3.0V	2.0V	7.2mA	8, 13
A-2				0.35	V	+25°C	+25°C	5.0V	3.0V	2.0V	7.2mA	8, 13
A-4				0.35	V	+125°C	+75°C	4.75V	3.0V	2.0V	7.2mA	8, 13
C-1	"0" INPUT CURRENT	-0.1		-0.6	mA	-55°C	0°C	5.25V	0.25V	5.25V		
A-2		-0.1		-0.6	mA	+25°C	+25°C	5.25V	0.25V	5.25V		
C-1		-0.1		-0.6	mA	+125°C	+75°C	5.25V	0.25V	5.25V		
A-4	"1" INPUT CURRENT			20	µA	+125°C	+75°C	5.0V	4.0V	0V		
A-6	PAIR DELAY	20		65	ns	+25°C	+25°C	5.0V			B.C.P.D. + 9	10, 15
C-8	OUTPUT FALL TIME			15	ns	-55°C	0°C	4.75V			A.C.P.D. + 2	11, 15
C-8	TURN-ON DELAY			40	ns	+25°C	+25°C	5.0V			B.C.P.D. + 9	10, 15
C-8	TURN-OFF DELAY			60	ns	+25°C	+25°C	5.0V			B.C.P.D. + 1	10, 15
C-3	INPUT CAPACITANCE			5.0	pF	+25°C	+25°C	5.0V	5.0V			7
A-8	POWER CONSUMPTION (OUTPUT "0" (Per Gate) OUTPUT "1"			55.4 5.5	mW mW	+25°C +25°C	+25°C +25°C	5.25V 5.25V	 0V			13
A-8	INPUT VOLTAGE RATING	5.5			V	+25°C	+25°C	5.0V	50µA	0V		
A-8	OUTPUT SHORT CIRCUIT CURRENT	-4.5		-10	mA	+25°C	+25°C	5.0V	0V		0V	

Notes:

1. All voltage and capacitance measurements are referenced to the ground terminal. Terminals not specifically referenced are left electrically open.
2. All measurements are taken with ground pin tied to zero volts.
3. Positive current flow is defined as into the terminal referenced.
4. Positive NAND logic definition: "1" = High Level, "0" = Low Level. "DOWN" Level = "0".
5. Proper ultimate measure should be taken to ensure current limiting in accordance with Absolute Maximum Ratings should the isolation diodes become forward biased.
6. Measurements apply to each gate element independently.
7. Capacitance as measured on Boonton Electronic Corporation Model 7-A-33 Capacitance Bridge or equivalent. f = 1 MHz, V_{bias} = 5.0V$_{DC}$. All pins not specifically referenced are tied to guard for capacitance tests. Output pins are left open.
8. Output source current is supplied through a resistor to ground. Apply 5.0V to one input terminal of associated AND gate.
9. Output sink current is supplied through a resistor to V_{cc}.
10. One (1) fan-out is defined as 0.6mA.
11. One AC fan-out is defined as 20pF.
12. To test "0" output voltage, apply 2.0V to the input terminal of one input AND gate and apply zero volts to the input terminals of the associated input AND gate. Reverse input conditions and measure again.
13. For output "1" power consumption test, apply zero volts to one input terminal of each of the input AND gates.
14. Signetics reserves the right to make design and process changes and improvements.
15. Detailed test conditions for AC testing are in Section 5.

PRELIMINARY SPECIFICATIONS

LOW POWER MONOLITHIC DCL ELEMENT

S8481A
S8481J
N8481A
N8481J

JULY 1967

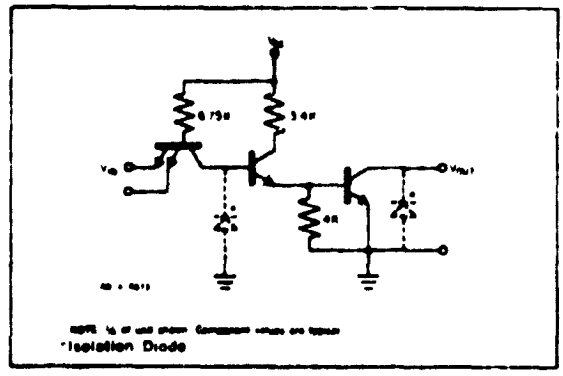
S8481A, S8481J QUADRUPLE TWO-INPUT TTL NAND GATE (−55°C to +125°C)

N8481A, N8481J QUADRUPLE TWO-INPUT TTL NAND GATE (0°C to +75°C)

The 8481 is a Quadruple, 2-Input NAND Gate with bare output collectors. Absence of any output pull-up structure allows the user complete freedom in the use of the 8481 in collector-logic (wired-AND) and similar applications. Proper pull-up resistor selection will allow as many as 30 outputs to be tied together. Attention must be given to the "1" DC noise margin and the "0" fan-out when selecting a pull-up resistor.

These devices are additional elements to the S8000J product line. For electrical characteristic curves, refer to the S8480J electrical characteristic curves in the S8000J data handbook

BASIC CIRCUIT SCHEMATIC

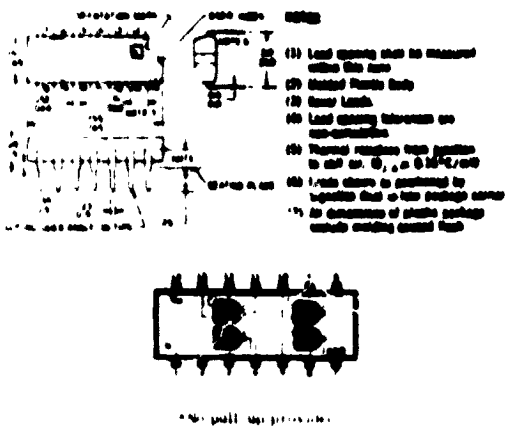


*Isolation Diode

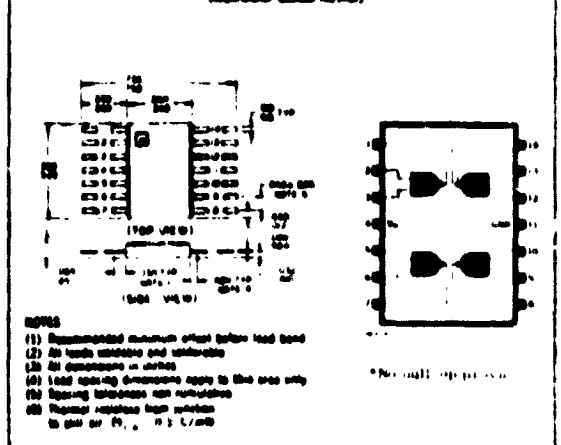
ABSOLUTE MAXIMUM RATINGS

INPUT VOLTAGE	+6.0V	OUTPUT CURRENT	+30, -10mA
OUTPUT VOLTAGE	+6.0V	OPERATING TEMPERATURE (S8481)	-55°C to +125°C
V_{CC}	+6.0V	(N8481)	0°C to +75°C
INPUT CURRENT	±10mA	STORAGE TEMPERATURE	-65°C to +150°C
		JUNCTION TEMPERATURE	+150°C

S8481A
N8481A
SIGNETICS A-PACKAGE



S8481J
N8481J
J-PACKAGE (TO-86)



S8481A S8481J N8481A N8481J

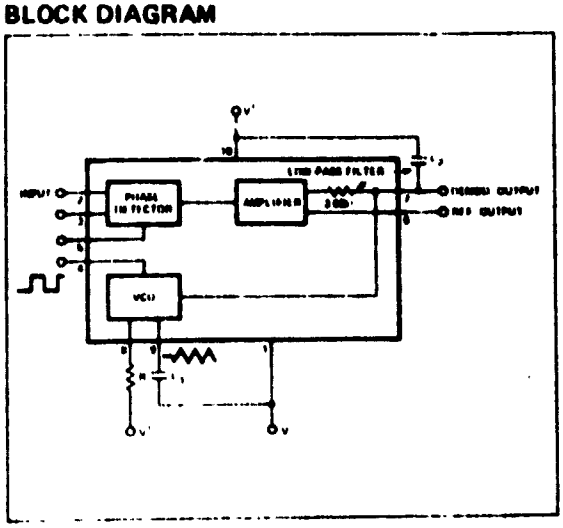
DESCRIPTION

The SE/NE565 Phase Locked Loop (PLL) is a self contained, adaptable filter and demodulator for the frequency range from 0.001 Hz to 500 kHz. The circuit comprises a voltage-controlled oscillator of exceptional stability and linearity, a phase comparator, an amplifier and a low pass filter as shown in the block diagram. The center frequency of the PLL is determined by the free running frequency of the VCO, this frequency can be adjusted externally with a resistor or a capacitor. The low pass filter, which determines the capture characteristics of the loop, is formed by an internal resistor and an external capacitor.

FEATURES

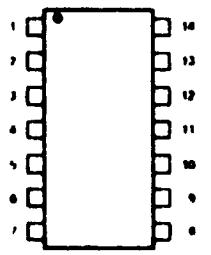
- EXTREME STABILITY OF CENTER FREQUENCY (200ppm/°C typ)
- WIDE RANGE OF OPERATING VOLTAGE (±6 to ±12 VOLTS) WITH VERY SMALL FREQUENCY DRIFT (100ppm/% typ)
- VERY HIGH LINEARITY OF DEMODULATED OUTPUT (0.2% typ)
- CENTER FREQUENCY PROGRAMMING BY MEANS OF A RESISTOR, CAPACITOR, VOLTAGE OR CURRENT
- TTL AND DTL COMPATIBLE SQUARE-WAVE OUTPUT, LOOP CAN BE OPENED TO INSERT DIGITAL FREQUENCY DIVIDER
- HIGHLY LINEAR TRIANGLE WAVE OUTPUT
- REFERENCE OUTPUT FOR CONNECTION OF COMPARATOR IN FREQUENCY DISCRIMINATOR
- BANDPASS, ADJUSTABLE FROM <±1% to >±60%
- FREQUENCY ADJUSTABLE OVER 10 TO 1 RANGE WITH SAME CAPACITOR

BLOCK DIAGRAM



PIN CONFIGURATIONS

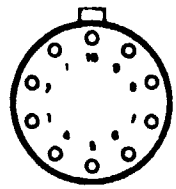
A PACKAGE
(Top View)



1. V⁻
2. Input
3. Input
4. VCO Output
5. Phase Comparator VCO Input
6. Reference Output
7. Demodulated Output
8. External R for VCO
9. External C for VCO
10. V⁺
11. NC
12. NC
13. NC
14. NC

ORDER PART NOS. SE565A/NE565A

K PACKAGE



1. V⁻
2. Input
3. Input
4. VCO Output
5. Phase Comparator VCO Input
6. Reference Output
7. Demodulated Output
8. External R for VCO
9. External C for VCO
10. V⁺

ORDER PART NOS. SE565K/NE565K

APPLICATIONS

- FREQUENCY SHIFT KEYING
- MODEMS
- TELEMETRY RECEIVERS
- TONE DECODERS
- SCA RECEIVERS
- WIDEBAND FM DISCRIMINATORS
- DATA SYNCHRONIZERS
- TRACKING FILTERS
- SIGNAL RESTORATION
- FREQUENCY MULTIPLICATION & DIVISION

REPRODUCIBILITY OF THE
ORIGINAL PAGE IS POOR

signetics DUAL COMMUNICATIONS EIA/MIL LINE RECEIVER | 8T16

PRODUCT AVAILABLE IN 0° TO +75°C TEMP. RANGE ONLY.

REFER TO PAGE 19 FOR A AND F PACKAGE PIN CONFIGURATIONS.

DIGITAL 8000 SERIES TTL/MSI

DESCRIPTION

The 8T16 Dual Communications Line Receiver provides receiving capability for data lines between Data Communication and Terminal Equipment. The device meets or exceeds the requirements of EIA Standard RS-232B and C, MIL-STD-188B and CCITT V24.

The receivers accept single (EIA) or double ended (MIL) inputs and are provided with an output strobing control. Both EIA and MIL input standards are accommodated.

When using the EIA input terminal (with the Hysteresis terminal open), input voltage threshold levels are typically +2V and -2V with a guaranteed minimum Hysteresis of 2.4V. By grounding the "Hysteresis" terminal, the EIA input voltage threshold levels may be shifted to typically +1.0V and +2.1V with a minimum guaranteed Hysteresis of 0.75V. (Note that when using the EIA inputs, the MIL inputs--both positive and negative--must be grounded).

The MIL input voltage threshold levels are typically +0.6V and -0.6V with a minimum guaranteed Hysteresis of 0.7V. A MIL negative terminal is provided on each receiver per specification MIL-STD-188B to provide for common mode noise rejection.

Each receiver includes a strobe input so that:

a. A "1" on the strobe input allows data transfer
b. A "0" on the strobe input holds the output high.

ABSOLUTE MAXIMUM RATINGS*

Input Voltage (EIA and MIL)	±25V
V_{CC}	+7.0V
Storage Temperature	-65°C to +175°C
Operating Temperature	0°C to +75°C

*Limiting values above which serviceability may be impaired

ELECTRICAL CHARACTERISTICS (Over Recommended Operating Temperature And Voltage)

CHARACTERISTICS	LIMITS				TEST CONDITIONS					OUTPUTS	NOTES
					INPUTS						
	MIN.	TYP.	MAX.	UNITS	EIA	MIL(+)	MIL(-)	HYS	STROBE		
"1" Output Voltage (EIA) ("Hysteresis" Open)	2.6	3.5		V	-3.0V	0V	0V		2.0V	-800µA	8, 10
"1" Output Voltage (EIA) ("Hysteresis" grounded)	2.6	3.5		V	+0.3V	0V	0V	0V	2.0V	-800µA	8, 10
"1" Output Voltage (MIL)	2.6	3.5		V		-0.1mA	0V		2.0V	-800µA	8, 11
	2.6	3.5		V		-0.9V	0V		2.0V	-800µA	8, 11
"1" Output Voltage (Strobe)	2.6	3.5		V	+3.0V	0V	0V		0.8V	-800µA	8
"0" Output Voltage (EIA) ("Hysteresis" Open)			0.4	V	+3.0V	0V	0V		2.0V	9.6mA	9, 12
"0" Output Voltage (EIA) ("Hysteresis" grounded)			0.4	V	+3.0V	0V	0V	0V	2.0V	9.6mA	9, 12
"0" Output Voltage (MIL)			0.4	V		+0.1mA	0V		2.0V	9.6mA	9, 13
			0.4	V		+0.9V	0V		2.0V	9.6mA	9, 13

T_A = 25°C and V_{CC} = 5.0V

CHARACTERISTICS	LIMITS				TEST CONDITIONS					OUTPUTS	NOTES
					INPUTS						
	MIN.	TYP.	MAX.	UNITS	EIA	MIL(+)	MIL(-)	HYS	STROBE		
"1" Output Voltage (EIA) ("Hysteresis" open)	2.8	3.5		V	+1.2V	0V	0V		2.0V	-800µA	8, 10
"1" Output Voltage (MIL)	2.8	3.5		V		+0.35V	0V		2.0V	-800µA	8, 11
"0" Output Voltage (EIA) ("Hysteresis" open)		0.2	0.4	V	-1.2V	0V	0V		2.0V	9.6mA	9, 10
"0" Output Voltage (MIL)		0.2	0.4	V		-0.35V	0V		2.0V	9.6mA	9, 11
Input Resistance (EIA)	3	5	7	kΩ	±25V	0.0V	0.0V				
Input Resistance (MIL)	7.5	11.4		kΩ	0.0V	±25V	0.0V				

AMERICAN MICRO-SYSTEMS, INC.
3800 HOMESTEAD ROAD, SANTA CLARA, CALIFORNIA 95051 (408) 246-0330

13 X 8 FIFO BUFFER REGISTER S1709

FUNCTIONAL DESCRIPTION – The S1709 contains thirteen 8 bit parallel in-parallel out shift registers and the control logic necessary to achieve a first-in, first-out, (SILO) memory configuration. External control signals allow cascading of many register arrays. The register may operate with independent input and output data rates. The S1709 functions by synchronously accepting an 8 bit input data word and shifting the data word thru the registers into the last unfilled register location. The control logic holds the data word in this location until an externally applied shift out command I_{SO} allows data to shift toward the output. The array is fabricated with AMI's low V_T process. Low cost TTL interface is achieved with push-pull outputs and external pull-up resistors on inputs.

TYPICAL APPLICATIONS

- Modems
- Bit Rate Smoothing
- Asynchronous-Synchronous Buffering
- CPU/Terminal Buffering
- Data Communications
- Peripheral Buffering

MAXIMUM RATINGS

Positive Voltage on any Pin	V_{SS} +0.3V
Negative Voltage on any Pin	V_{SS} −19V
Storage Temperature	−65°C to +150°C
Operating Temperature	0° to +70°C*

*Military Range available upon request.

SPECIFICATIONS – (T_A = 0° to +70°C, V_{SS} = +5V ± 5%, V_{GG} = −12V ± 5%)

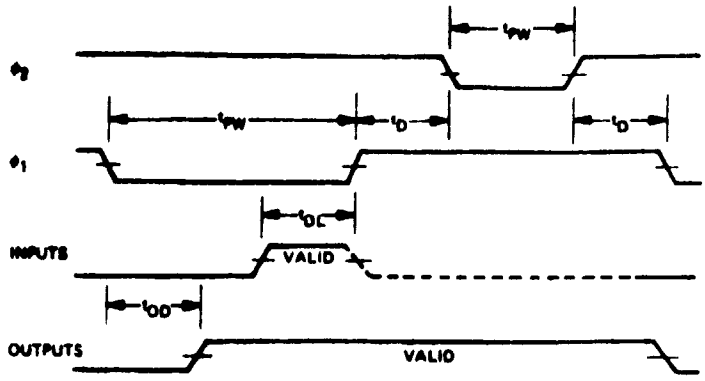
	Min.	Typ.	Max.	Units	Conditions
V_{IH} (Data)	V_{SS} −1.5			Volts	
V_{IL} (Data)			+0.4	Volts	
V_{IH} (ϕ1, ϕ2)	V_{SS} −1.5			Volts	
V_{IL} (ϕ1, ϕ2)			−10.0	Volts	
V_{OH}	V_{SS} −1			Volts	Data load = 1 TTL input
V_{OL}			+0.3	Volts	Control load = 1 MOS input
Frequency	.01		0.1	MHz	C_{LOAD} = 25pf
t_{PW} (ϕ1)	6.5			μs	
t_{PW} (ϕ2)	1.5			μs	$t_r = t_f \leq 25$ns
t_D	.200			μs	
t_{OD}	6.5			μs	
t_{DL}	.700			μs	
C_{IN}		15		pf	
C_{OUT}		15		pf	$V_{IN} = V_{SS}$
C_ϕ		100		pf	
I_{DD}		30		ma	f = 0.1 MHz

This sheet is intended to inform customers of a new circuit design that is being considered. AMI makes no representation or warranties of any kind that these circuits are free from patent infringement.

REPRODUCIBILITY OF THE
ORIGINAL PAGE IS POOR

Symbols and Definitions

t_{PW} – Pulse Width
t_D – Delay time between $\phi 1$ and $\phi 2$ pulses.
t_{DL} – Data Lead Time. Time that input data must be valid before trailing edge of $\phi 1$.
t_{OD} – Output Delay. Propagation delay from leading edge of $\phi 1$ to valid output data.



TIMING DIAGRAM

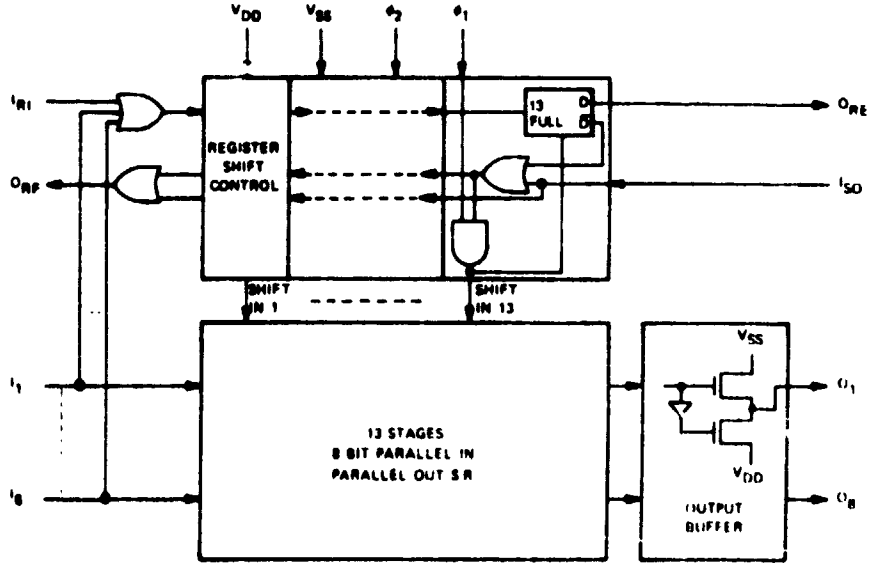
Symbols and Definitions

I_{RI} – Read Input Command. A V_{IH} signal on I_{RI} generates a read input command when I_1 thru I_8 contain V_{IL} signals.

I_{SO} - Shift Out Command. A V_{IH} on I_{SO} causes data in all registers to shift to the following register once each clock period. A V_{IL} causes the register array to hold stored data indefinitely

O_{RE} – Output Register Empty Indicator. V_{OL} indicates an empty 13th register. This signal is used when cascading arrays.

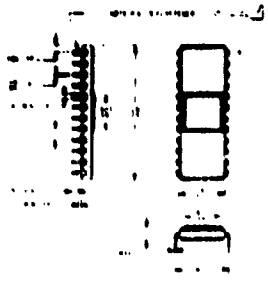
O_{RF} – Register Array Full Indicator. V_{OL} indicates a fully loaded register array causing new data to be ignored. This signal is used when cascading arrays.



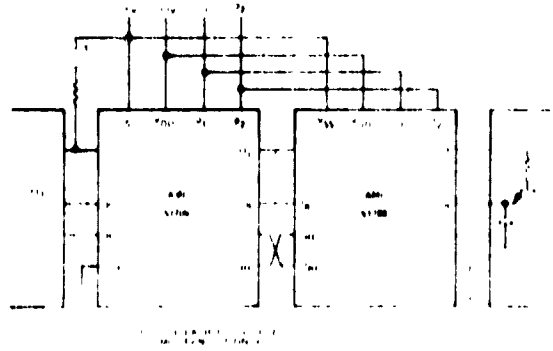
FUNCTIONAL DIAGRAM

L PACKAGE
24 PIN DUAL-IN-LINE

Pin	Function	Pin	Function
1	I_5	13	O_1
2	I_6	14	O_{RE}
3	I_7	15	I_{SO}
4	I_8	16	ϕ_1
5	V_{DD}	17	ϕ_2
6	O_{RF}	18	V_{SS}
7	I_{RI}	19	I_{RI}
8	I_{SO}	20	I_{SO}
9	I_1	21	I_1
10	I_2	22	I_2
11	I_3	23	I_3
12	I_4	24	I_4



PIN/PACKAGE CONFIGURATION



TTL CONNECTION

RCA digital integrated circuits

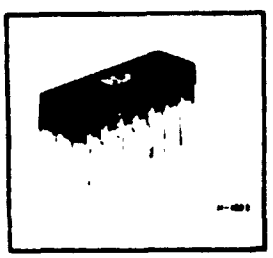
BCD to 7-Segment Decoder-Drivers

Monolithic Silicon

CD2500E
CD2501E
CD2502E
CD2503E

File No. 392

30mA and 30mA/Segment DECODER-DRIVERS For Use With Low-Voltage Digital Display Devices, Lamps, and Relays



RCA CD2500E series 7-Segment Decoder-Drivers are monolithic MSI integrated circuits which decode BCD (8-4-2-1 code) inputs to 7-line outputs representing a decimal number from 0 to 9 on 7-segment incandescent display devices.

RCA CD2500E and CD2501E are 30 mA per-output-line devices designed for use with incandescent display devices such as the RCA DR2000 and DR2010. The CD2500E, in addition to the outputs for the 7-segment display device, has a decimal point output, the CD2501E also has a special-feature, a terminal to provide for ripple blanking output and intensity control input. The ripple blanking output blanks out all non-significant zeroes in the numerical display. The ripple blanking output terminal is also available for use as an intensity control input from an external variable pulse-width control source, as shown in Fig. 7.

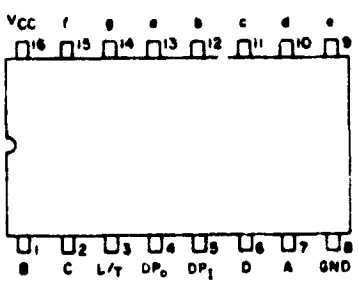
RCA CD2502E and CD2503E are 80 mA-per-line versions of the CD2500E and CD2501E, respectively, and are designed for use with high-current lamps and relays.

RCA CD2500E series devices are supplied in 16-lead dual in-line plastic packages which can be used over the operating temperature range of 0° C to +75° C.

DP_O = Decimal Point Output
DP_I = Decimal Point Input

DP_I must be supplied from an external source

CD2500E and CD2502E perform the inverter-driver function necessary to energize the decimal point filament in the display device.



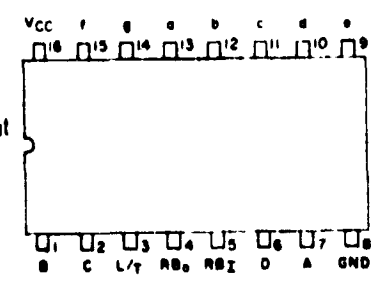
92CS-4177

Fig. 1 - CD2500E and CD2502E (with decimal point)

FEATURES:

- **High current sinking capability for direct display driving**
- **Intensity control provision**
- **BCD inputs are compatible with commercially available DTL & TTL devices**
- **Lamp test provision**
- **5 V power supply**
- **Clamp diodes on all inputs**
- **Lamp supply up to +12 volts**
- **Ripple blanking capability**
- **Decimal point output**
- **Over-range detection (automatic blanking of display device when BCD input > 9)**

RB_O = Ripple-Blanking Output & Intensity Control Input
RB_I = Ripple-Blanking Input



92CS-15521

Fig. 2 - CD2501E and CD2503E (with ripple blanking and intensity control provision)

Information furnished by RCA is believed to be accurate and reliable. However, no responsibility is assumed by RCA for its use nor for any infringements of patents or other rights of third parties which may result from its use. No license is granted by implication or otherwise under any patent or patent rights of RCA.

REPRODUCIBILITY OF THE
ORIGINAL PAGE IS POOR

FEATURES:

- **NO FREQUENCY COMPENSATION REQUIRED**
- **SHORT-CIRCUIT PROTECTION**
- **OFFSET VOLTAGE NULL CAPABILITY**
- **LARGE COMMON-MODE AND DIFFERENTIAL VOLTAGE RANGES**
- **LOW POWER CONSUMPTION**
- **NO LATCH UP**

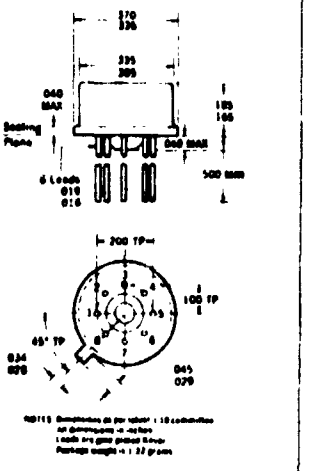
GENERAL DESCRIPTION — The μA741C is a high performance monolithic operational amplifier constructed on a single silicon chip, using the Fairchild Planar* epitaxial process. It is intended for a wide range of analog applications. High common mode voltage range and absence of "latch-up" tendencies make the μA741C ideal for use as a voltage follower. The high gain and wide range of operating voltages provide superior performance in integrator, summing amplifier, and general feedback applications. The μA741C is short-circuit protected, has the same pin configuration as the popular μA709C operational amplifier, but requires no external components for frequency compensation. The internal 6dB/octave roll-off insures stability in closed loop applications. For full temperature range operation (−55°C to +125°C) see μA741 data sheet.

ABSOLUTE MAXIMUM RATINGS

Supply Voltage	±18 V
Internal Power Dissipation (Note 1)	500 mW
Differential Input Voltage	±30 V
Input Voltage (Note 2)	±15 V
Voltage between Offset Null and V	±0.5 V
Storage Temperature Range	−65°C to +150°C
Operating Temperature Range	0°C to +70°C
Lead Temperature (Soldering, 60 sec)	300°C
Output Short-Circuit Duration (Note 3)	Indefinite

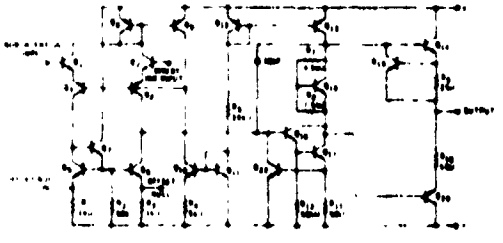
PHYSICAL DIMENSIONS

In accordance with JEDEC (TO 99) outline

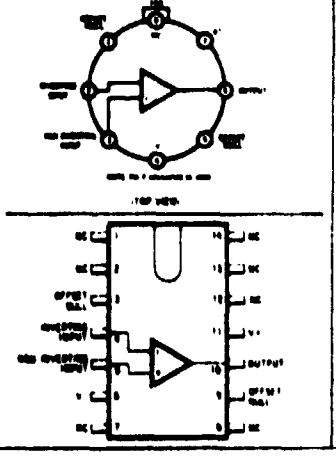


ORDER PART NO. USB7741393

EQUIVALENT CIRCUIT



CONNECTION DIAGRAMS



TYPICAL DUAL IN-LINE PACKAGE

Similar to JEDEC (TO 116) Outline

NOTES: All dimensions in inches.
Leads are intended for insertion in hole rows .100 (2.54) centers.

ORDER PART NO. USB7741193

NOTES:
(1) Rating applies for ambient temperatures to +70°C.
(2) For supply voltages less than ±15 V, the absolute maximum input voltage is equal to the supply voltage.
(3) Short circuit may be to ground or either supply.

*Planar is a patented Fairchild process.

COPYRIGHT FAIRCHILD SEMICONDUCTOR 1969 • PRINTED IN U.S.A. 04 BN 0025 49 10M
MANUFACTURED UNDER ONE OR MORE OF THE FOLLOWING U.S. PATENTS: 2981877, 3015048, 3025589, 3064167, 3108359, 3117260, OTHER PATENTS PENDING.

V-PAC*
POWER SOURCE SPECIFICATIONS

TYPES: VA 15-15
VA 12-12
VA 12-6

Reliability, Inc.

A POWER SOURCE FOR OPERATIONAL AMPLIFIERS

- **VERSATILE:** Operates up to 25 type 709 op amps from one VA 15-15
- **COMPACT:** Less than one third cubic inch
- **RELIABLE:** Solid state active components
- **ECONOMICAL:** Designed for conventional PC card assembly techniques

GENERAL DESCRIPTION:

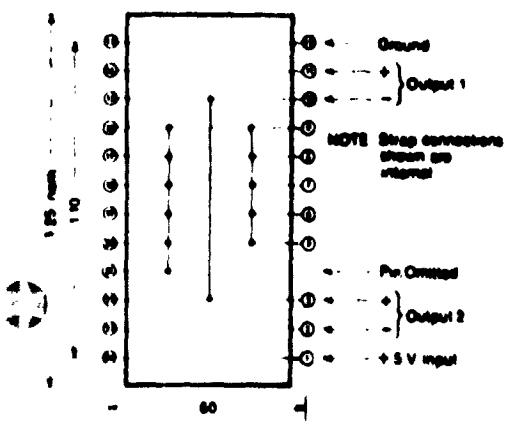
Standard +5 volt V_{cc} is used to supply special voltages required for most IC operational amplifiers. Because of its small size and packaging, the V-PAC power source may be assembled on the same PC cards used for the op amps and associated digital ICs. This reduces manufacturing costs, allows greater miniaturization, and improves reliability.

All V-PAC power sources are molded in filled thermo setting resin. Size and pin spacing is completely compatible with modern IC assembly practice on PC cards or with wire wrap assemblies. All units are short circuit protected, automatically self-restoring.

APPLICATIONS:

The primary area of application of the V-PAC op amp power source is in digital systems where analog signals are present. Specific circuit applications cover a wide range, including sample-and-hold circuits, A/D and D/A converters, AC and DC amplifiers, modulators and demodulators, comparators, photo sensors, integrators and differentiators, and most other applications where operational amplifiers are used.

PIN CONNECTIONS AND PACKAGE DIMENSIONS:



Height above mounting plane: ⅜ inch, maximum

Lead length from mounting plane: ⅛ inch, maximum

Copyright, Reliability, Inc

V Note #1
4/72

*Trademark, Reliability, Inc.

OPCOA INC.
330 TALMADGE ROAD • EDISON, NEW JERSEY 08817 • (201) 287-0355

SLA-1
Seven-Segment Numeric Display

SOLID-LITE

Solid State Numeric Display

Actual Size

SEVEN-SEGMENT NUMERIC WITH DECIMAL POINT, USING GALLIUM PHOSPHIDE RED-LIGHT-EMITTING DIODES

Features:

- Low cost
- High brightness with high contrast
- Operates with standard IC decoder/drivers, at IC power supply levels
- Large ⅓-inch character
- Low power
- Standard 14-pin dual-in-line package
- Long-life – solid state reliability
- Mechanically rugged – with only 8 light-emitting diodes and 9 pins
- Single-plane character – wide-angle viewing
- No RFI problem
- Fast switching – suitable for time-shared operation

OPCOA Solid-Lite Seven Segment Numeric Displays use high efficiency red electroluminescence from gallium phosphide which emits light in all directions. Each rectangular segment is formed by reflection of the multidirectional light from a single semi conductor diode emitter. This produces an easily viewable "jeweled" numeric display.

Type SLA-1 Solid-Lite Numeric Display may be mounted in a standard 14-pin DIP socket or directly in a PC board. It can operate directly from available TTL 16-lead seven-segment decoder/drivers (see note 2). It incorporates the necessary diode isolation required for time-shared (matrix) operation.

Absolute Maximum Ratings

Power dissipation at 25°C	750 mW
Power derating above 25°C	10 mW/°C
Reverse voltage	5.5 volts
Continuous forward current per cathode	40 mA
Storage and Operating Temperature	−55°C to 100°C
Soldering Temperature 1/16 in. from case for 5 seconds	260°C

Optical Characteristics per cathode @ I_f = 15 mA (25°C)

Symbol	Parameters	Min	Typ.	Units
L	Luminance (Brightness) (Note 1)	100	300	fL
I	Luminous Intensity (Note 1)	0.35	1.0	mcd
λ_p	Peak emission wavelength		660	nm
$\Delta\lambda$	Spectral half line width		85	nm
t_r and t_f	Rise and fall time		450	nsec

Electrical Characteristics per cathode (25°C)

Symbol	Parameters	Min	Typ.	Max	Units
V_f	Forward Voltage @ 15 mA	1.8	2.1	2.8	volts
I_R	Reverse Current @ 5.5 volts			50	μA
C	Capacitance @ 0 volts 1 MHz		100		pf

From Analogue Tape to Digital Tape

J.D. Redman

TABLE OF CONTENTS

INTRODUCTION

SECTION I - DATA FORMAT DESCRIPTION

SECTION II - PLAYBACK AND REPRODUCTION OF DSEA TAPE

SECTION III - THE DATA ACQUISITION SYSTEM

SECTION IV - LUNAR DATA DIGITIZATION

FIG. # 1 - METHOD OF RECORDING SEP DATA

2 - SCIENTIFIC DATA FORMAT

3 - NAVIGATION DATA FORMAT

4 - SEP DATA REDUCTION PROCESS

5 - PRODUCTION OF ANALOGUE COPY OF DSEA TAPE

6 - SEP DATA ACQUISITION SYSTEM

7 - DIGITAL DATA FORMAT ON MAGNETIC TAPE

8 - LUNAR DATA DIGITIZATION - SYSTEM CONFIGURATION

9 - 5.2 KHZ REFERENCE FREQUENCY MULTIPLIER

10 - SCIENTIFIC DATA DIGITAL TAPES

APPENDIX

A - DATA REDUCTION COMPLEX TELEMETRY OPERATIONS PROCEDURE

B - MEMO-REDUCTION AND ANALYSES OF SEP NAVIGATION DATA

C - MEMO-SEP DATA FROM STATION #4 TO STATION #5

D - MEMO-SEP RECEIVER TEMPERATURE DATA RECORDED DURING EVA-II

E - MEMO-DAS DIGITIZING ACCURACY

F - MEMO-SEP-FALSE RESET INDICATION IN DATA FROM EVA-II

G - MANUAL-SEP EXPERIMENT MK-II DATA ACQUISITION SYSTEM

H - MEMO-CALIBRATION AND TRANSMITTER-OFF DATA

Introduction:

It is the intent of this report to describe the method and equipment used in recovering the data recorded on the DSEA (Data Storage Electronics Assembly) during the operation of the SEP experiment conducted on the Lunar surface during Apollo 17. The phrase "recovering the data" describes the process of changing the format of the recorded data from that of three separate multiplexed signals of frequency modulated data with different center frequencies, recorded on one channel of an audio tape recorder (the DSEA), into that of a stream of demultiplexed and digitally formatted data suitable for recording on a digital tape recorder or for immediate processing by a digital computer. The data are a set of measurements of the field strengths of three orthogonal components of the magnetic field at six different frequencies and information from the Lunar Rover navigation computer giving the location on the Lunar Surface at which each of the measurements of the field strength was taken.

The report has been divided into several different sections. In the first section the format of the data as recorded on the DSEA will be described. Section two will give the procedure used to playback the DSEA tape, and to produce a recording of that data suitable for use with the Data Acquisition System (DAS). The third section will

outline in general terms the design of the DAS and the details of its circuit design will be included in a manual accompanying this report. The fourth section will describe, in detail, the processing of the Lunar data by the DAS and the difficulties encountered in the procedure resulting from data dropouts and other anomolous characteristics of the data.

I - DATA FORMAT DESCRIPTION:

The DSEA receives two inputs from the SEP receiver (see Figure#1). One is the output of a voltage controlled oscillator (VCO) with a frequency range of 300 hz to 5700 hz containing the magnetic field strength data and receiver status information which will be referred to here as the "Scientific Data" signal. The other is a digitally formatted bit stream of "1" s and "0"s which contains data from the Lunar Rover navigation computer and it will be referred to as the "Navigation Data" signal.

The DSEA filters the Scientific Data signal with a 300 hz - 3000 hz bandpass filter. The Navigation Data signal is reformatted from two voltage levels into two frequencies of 4175 hz and 4625 hz by a multivibrator. The outputs of the filter and the multivibrator along with an internally generated 5.2 Khz Reference signal are summed together and then recorded on a single track of the magnetic tape. The

three separate signals are recovered later by filtering of the data during playback of the composite recorded signal.

The multiplexed Scientific Data is a series of 33.75 msec. Words, each of which has either a frequency related to the received field strength, to the internal temperature of the receiver, to a known noise source or with a known frequency of 5700 hz carrying information with respect to the receiver status and providing a recognizable synchronization Word for demultiplexing the data. The format for this data stream is given in Figure #2.

If the receiver has synchronized itself with the transmitter, then during Frequency Frame #1 the transmitter is operating at 16 mhz while transmitting first on the north-south dipole for 101 msec. and then on the east-west dipole for the same time period. In each of these 101 msec. Frequency Subframes the receiver measures the field strength for 33 msec. sequentially on the x, y and z antennas. During Frequency Frame 15 and 16 the transmitter is turned off to allow the measurement of background cosmic noise and of receiver front end noise and to provide calibration with a known internal noise source. In Frequency Frame 32 the transmitter sends out a synchronizing code at 1 or 2 mhz and the receiver provides a sequence of six Words whose frequency, depending on the status of the receiver, either is proportional to the internal receiver temperature or is set to 5700 hz. The data for this Frame 32 which is recovered from the DSEA recording appears as a sequence of 33 msec.

"1"s and "0"s (see Figure 2B) because it is filtered by the 300 hz - 3000 hz bandpass filter in the DSEA.

The Data Frame, that repeats every 38.4 seconds, contains six Data Subframes (a Record) each of 6.48 second duration whose format is the same excepting the calibration in Frequency Frame 15 and 16 where different frequencies are calibrated depending on the Data Subframes and excepting Frequency Frame 32 where the synchronization code is transmitted and received on different antennas.

When the receiver is operating in Mode I and attempting to acquire synchronization with the transmitter, then the receiver remains connected to one receiving antenna as defined by the receiver status during three consecutive Data Subframes and is then switched to the next receiving antenna repeating the process until synchronization is reacquired.

The receiver status information which is contained in Frequency Frame 32 applies to the following Data Subframe rather than to the Data Subframe in which it is contained. This is an anomolous condition which arose because of some confusion as to the data format at the time when the DAS was constructed.

The Navigation Data is a series of "1"s and "0"s recorded in analogue form as the two frequencies 4025 hz and 4175 hz. Referring to Figure #3, it can be seen that

each Navigation Data Frame is 78.75 msec. in duration and contains odometer pulses from two wheels each equivalent to .49 meters, bearing up and down pulses equivalent to a 1° change in bearing, range up and down pulses equivalent to a .1 km change in range and a synchronization pulse that is always a "1". The presence of a pulse in indicated by a "1" or 4625 hz during the relevant 11.25 msec. time slot. In order to have a unique recognizable synchronization pulse which will allow recovery of the data it is necessary to make assumptions about the highest rate at which each of the other pulses can occur. A result of these assumptions is that for a Rover velocity of less than 22.4 km/hr only the synchronization pulse can occur during four consecutive Navigation Data Frames. This fact allows the position of the synchronization pulses and hence the presence or absence of other pulses to be determined for the relevant four Navigation Data Frames.

II - Playback and Reproduction of DSEA Tape

The DSEA is a lighweight, portable, space qualified audio tape recorder with the capability of recording 10 hours of data on a single cartridge. These features resulted in a unique design for the tape cartridge allowing the tape to be played back only on a unit specifically designed for that purpose. There are three of these tape

stations. The data discussed herein was played back on one of these units situated in Building 12 at JSC.

A special 1/4" magnetic tape with a thin oxide coating is used in the cartridge. The tape is easily damaged and each playback of the data further degrades its quality. These circumstances necessitated recording the data with another analogue recorder which could be used in the data reduction process. The Data Acquisition System used a 7-track instrumentation type tape recorder (Lockheed Electronics Model 417-D) with direct reproduce capability at 3 3/4 IPS. Therefore, a tape suitable for use with the DAS was produced along with a higher quality FM recording at 15 IPS on a 14-track recorder (Ampex Model FR-1800). A document produced by Lockheed contract personnel at JSC outlining the procedure to be used in producing these tapes is included in the Appendix.

The DSEA Playback Station provides the following output signals: Raw Data, Filtered Data, 5.2 Khz Reference and Bi-level Sync. The Raw Data is the composite signal (unfiltered) as described in Section I. The Filtered Data signal is the output of a 300 - 3000 hz bandpass filter and is the recovered Scientific Data signal. The 5.2 Khz Reference signal is the output of a bandpass filter centered at 5.2 Khz. Bi-level Sync is a bit sequence from the output of a discriminator whose output logic level is determined by its input frequency (either 4175 hz or 4625 hz). This output is the Navigation Data signal.

In Figure # 5, a block diagram of the signal flows gives an outline of the conditioning required by outputs of the DSEA Playback Station and gives the equipment setup used during the playback procedure. A locally generated time is recorded to aid in the data reduction procedure. The output signal levels are monitored and recorded on a strip chart recorder for later reference. A detailed description of the equipment setup is given in a section in the appendix entitled "DRC Telemetry Operations Procedure".

The Playback Station has two modes of operation, designated the Test mode and the Operate mode. In the Operate mode the 5.2 Khz Reference signal recorded on the DSEA tape is used on playback as a reference frequency to control the tape speed and thus to compensate for variations in tape speed that occurred during the recording process. The Test mode allows the system to function in a state in which the tape speed is constant and uncompensated. When used in the Operate mode the level of the 5.2Khz Reference signal is monitored and if it is less than a preset threshold then the system switches to the Test mode. This switching from one mode to the other produces transients in the tape speed that can give data losses (sections of missing data) of 20 - 30 msec. duration. These data dropouts can cause loss of synchronization in the DAS resulting in the

loss of a complete Record of 6.48 seconds of Scientific Data and as well can produce erroneous pulses in the navigation data. It was observed during playback of the flight data in the Operate mode that this problem did occur; therefore, it was played back again in the Test mode. It is the tape produced by this latter method that has been used in the major portion of the data reduction efforts.

III - The Data Acquisition System

The magnetic tape which was produced by the methods described in the previous section contains analogue data in a multiplexed format that is recovered by the Data Acquisition System and converted to a usable digital format.

The DAS was designed and built in the Planetary and Earth Sciences Division at JSC by G. Wagner and D. Pate of Lockheed Electronics Company. No attempt will be made in this report to describe the detailed circuit design of the DAS; however the general principles and concepts involved will be described. Included with this report, in the Appendix, is a manual prepared by G. Wagner that describes in detail the design of the DAS.

The purpose of the DAS is to recover both the Scientific Data and the Navigation Data, to convert them to a digital format, to record this digital data on a magnetic recorder and

to transmit this digital data to a programmable calculator (Wang - Model 720C) for immediate processing.

The analogue data tape that was produced as described in Section II provides the DAS with four separate inputs that must be conditioned to produce digital TTL compatible outputs (refer to Figure # 6). Both the 5.2 Khz Reference signal and the Scientific Data signal suffer from dropouts and amplitude variations that are a result of the poor quality of the DSEA recording. To overcome this difficulty automatic gain control (AGC) circuitry is used for both of these inputs. The output signal of the AGC circuit is then conditioned by a Schmitt trigger circuit whose output is TTL compatible. The IRIG-B time signal is amplified and conditioned by a Schmitt trigger. The Navigation Data is amplified and decoded by a phase lock loop providing a TTL output.

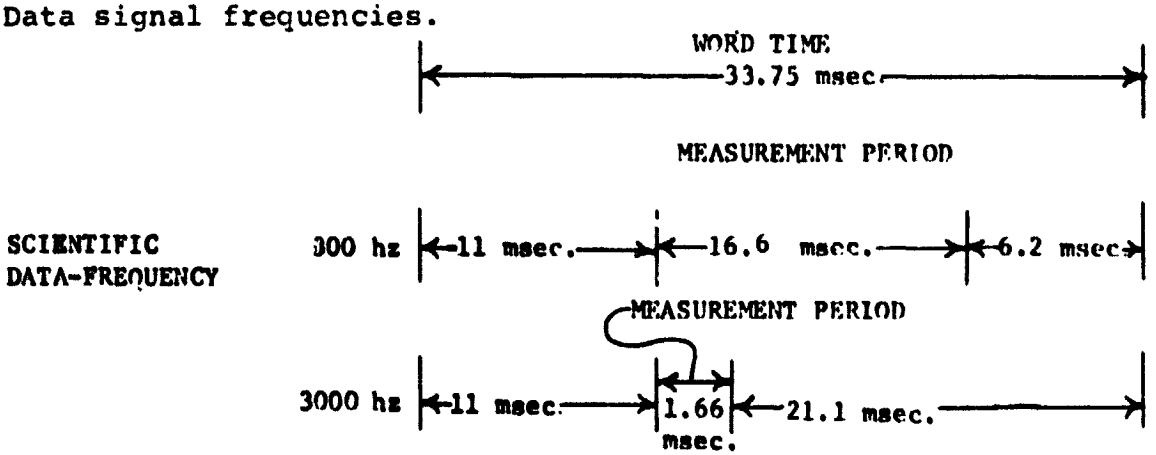
To recover the data it is necessary for the DAS to synchronize itself with the Scientific Data signal. To accomplish this, the DAS either manually or automatically goes into a "Prime Mode" in which it waits until the amplitude of the recovered Scientific Data signal is below a preset threshold continuously for a duration of 15 msec. When this condition occurs and the amplitude rises again above this threshold, the DAS assumes that it is in Frequency Frame 32 (refer to figures 2(a) and (b)) at the beginning of Word 2 in the Scientific Data stream. Thus since the DAS has

now synchronized itself with the Scientific Data signal a "Sync Detect" pulse is generated that initialized the Word, Frame and Subframe generator. A system clock is required to provide the timing information necessary for demultiplexing and generating these Word times. The clock operates at a nominal 10.4 Kc and is produced by multiplying the 5.2 Khz Reference signal frequency by a variable multiplier between 1.500 and 2.500. The variable multiplier is required because the frequency of the 5.2 Khz Reference signal is not known accurately, suffers from dropouts and as well varies with temperature (i.e. the temperature of the DSEA at the time of recording). This system clock must be stable enough over the 6.48 second Record time, until the next "Sync Detect" pulse is generated to reinitialize the timing, to ensure that the correct Word is being sampled. For example, a 5 msec. error in timing after 6.48 seconds corresponds to a .08% change in the 5.2 Khz Reference signal frequency.

The Word, Frame and Subframe generator produces a "Word Start" pulse at the beginning of each Word time. This pulse begins each measurement cycle of the Scientific Data signal. The Voltage Control Oscillator in the receiver whose output is the Scientific Data signal, has a finite rise and fall time and since the input the VCO is switched each Word time, the output must be given time to settle before

it is measured. The rise and fall times corresponding to an 80 db change in input signal are approximately 5 msec. Also there is a $\pm$ 3 msec. ambiguity in timing between the transmitter and the receiver. Therefore, the first 8 msec. and the last 3 msec. of the 33.75 msec. Word time must be rejected assuming the DAS to be in perfect synchronization with the original data. By selecting the appropriate Gate Delay and Gate Duration the sampling period and position can be varied.

The Gate Delay is a variable that can be set by a front panel switch on the DAS to any duration from 1 to 33 msec. The Gate Duration can be selected by setting the number of Scientific Data signal cycles(from 1 to 7 cycles) whose period is to be measured. Obviously the time of the Gate Duration depends on the frequency being measured since the number of cycles is fixed. For the illustration below the Gate Delay has been set at 11 msec. and the Gate Duration at 4 cycles which are the settings used with the Lunar data. The measurement periods during the Word time are shown for the two extremes of Scientific Data signal frequencies.



The measurement period of 4 cycles can lie anywhere in a time slot of 5 cycles, with its position depending upon the phase relationship between the Scientific Data signal and the system clock.

In order to determine the original received field strength during each Word time, the frequency of the Scientific Data signal and of the 5.2 Khz Reference signal must be measured simultaneously. The frequency of the originally recorded 5.2 Khz Reference signal is assumed to be known and can be used as a calibration to correct for tape speed fluctuations at the time of recording and of reproduction by using the following relationship:

$$fc = fs \left(\frac{5200}{f_R} \right)$$

fc - calibrated frequency of Scientific Data signal
fs - measured frequency of Scientific Data signal
f_R - measured frequency of 5.2 Khz Reference signal

The frequency of the Scientific Data signal is determined by measuring the period (VCO Gate) of a fixed number of cycles of the Scientific Data signal as preset by the Gate Duration. Simultaneously the 5.2 Khz Reference signal frequency is determined by measuring the number of its cycles during the VCO Gate time and the period of those cycles. The periods can be measured with a resolution of either 1 or 10 microseconds. After the measurement has been completed the digital outputs are stored in an

internal memory for transfer to the digital tape and to the Wang 720 calculator during the next record.

The DAS continues measuring the Scientific Data signal frequency and storing the data until it arrives at Frequency Frame 32 - Subframe 1 - Word 1 where it expects to find an amplitude level of zero for the Scientific Data signal. If this Sync is found, then when the amplitude changes to a non-zero value, the DAS generates another Sync Detect pulse correcting any timing error which might have developed since the previous Sync Detect. The measurement cycle for the next Record is then initiated. If the Sync is not found in the expected 33 msec. time slot then the DAS generates its own Dummy Sync Detect initiating the measurement cycle for the next Record. If in that next Record as well the Sync is not found then the DAS switches to a Prime Mode and waits for the next Sync before continuing the measurement cycle.

During each Record other ancillary data is also stored in the memory. This includes the accumulated Tape Time, accumulated Navigation Data and Receiver and DAS Status information. These other variables are measured once during each Record. Their exact nature will be discussed in the digital tape format description.

The Navigation Data must also be recovered for each Record.

The output from the Navigation Decoder has a logic level of "1" or "0" depending on the input frequency. This output suffers from noise problems requiring the use of a Pulse Width Discriminator that rejects "1" logic levels and "0" logic levels that are shorter in duration than 5 msec. The Navigation Data Demultiplexer examines in a shift register 22 consecutive 11.25 msec. bits from its input bit stream and tests for the presence of the "Sync" bit (a "1") in bit positions, 1, 8, 15 and 22. If the test for the "Sync" bit in those positions is positive then the other bits are thus identified and are stored in an internal memory.

The Odometer, Bearing and Range bits are counted in accumulators and once during each Record the contents of these accumulators are stored in the internal memory. In another possible mode of operation the Navigation Data are not demultiplexed but are stored directly as six bit segments. This mode is required in cases where the data is degraded and has missing bits or where the "Sync" bit is not the only bit present for 4 consecutive 78.75 msec. Navigation Data Frames. Both of these difficulties were present in the Lunar data.

The DAS is also capable of operating in a free run mode in which it does not search for the Sync in the Scientific Data but generates its own Dummy Sync Detect for

each Record. This allows the Navigation Data to be treated separately from the Scientific Data. The Scientific Data recovered in this manner is useless but the Navigation Data can be completely recovered regardless of the degraded quality of the Scientific Data. For the Lunar data this approach was used.

By the methods outlined previously the Scientific and Navigation Data are stored simultaneously in an internal memory of the DAS for the complete Record. This stored data is then transferred to the Wang 720C and to the digital tape recorder during the subsequent Record. The block diagram of the DAS as shown in Figure #6 is a simplistic representation and does not include the memory, input-output buffers, Wang 720C output control, the tape recorder controller and several other essential functional blocks. A complete and detailed description is to be found in the enclosed manual.

The format of the data on the digital tape is given in Figure #7. It is essentially self-explanatory but does require some expansion. The DAS Sync Status is 1 if the DAS generated a Sync Detect pulse and is 0 if it was necessary to generate a Dummy Sync Detect. The Receiver Status-Reset is 1 if the receiver acquired a Reset pulse and is a 0 if it did not (see Figure 2(B)). The Receiver Status-Mode is the

complement of M,X, and Y as given in Figure 2(B). The Wang 720C Sync Word is always an octal 13.

IV - Lunar Data Digitization

In digitizing the Lunar data it was necessary to try different system configurations to arrive at an optimum approach in the sense of reducing the data losses and improving the system resolution and repeatability. Throughout this process the Wang 720 programmable calculator proved invaluable in assessing in real time the effect of changing any variable in the DAS or in its associated filters and threshold detection circuitry. This section will discuss the peculiar problems involved with processing the Lunar data and their solution.

It was found that the analogue tape copy of the DSEA recording that was produced with the Playback Station in the Test Mode (i.e. tape speed uncompensated) proved to be superior to the other copy produced in the Operate mode in terms of fewer data dropouts and missing data segments. This former tape copy was used in all the data digitization.

One of the major difficulties encountered in digitizing the Lunar data was the poor quality of the data recovered from the DSEA. There were numerous data dropouts, amplitude fluctuations and severe distortion of the waveforms at frequencies below 500 hz. The degree of degradation increased continuously

as the end of the recorded data was approached. This has been attributed to the increasing temperature of the DSEA and the resultant degradation of the magnetic tape at these higher temperatures. During the data recording periods the Receiver and inferred DSEA temperature varied from 80°F to 115°F and reached a maximum of 125°F during other non-operational periods. Because of the existence of these problems the conditioning circuitry took on increased importance and its adjustment for the highest quality output became more critical and difficult.

The Scientific Data was first conditioned by a low pass filter with a 3 db cutoff frequency of 5.6 Khz to further attenuate undesired high frequency content. The signal was then conditioned by a high pass filter with a 200 hz cutoff frequency, for the purpose of decreasing the amplitude of low frequency oscillations that occurred during Frequency Frame 32 - Word 1. For the duration of this Word time there should always be zero amplitude level to allow synchronization of the data with the DAS. The amplitude fluctuations were decreased by the use of an AGC circuit for the purpose of improving the operation of the following Schmitt trigger that produced the final TTL compatible output. The zero amplitude Sync Words were recovered by monitoring the RMS level of the input to the AGC circuit and by forcing the output of the Schmitt trigger

to "0" whenever this input was below a preset threshold. The setting of the gain, threshold level and the response time of the AGC circuit in this conditioning system was accomplished by a "trial and error" method in which one attempted to decrease both the number of losses of synchronization in the DAS and the number of data dropouts.

The 5.2 Khz Reference signal level also had amplitude variations requiring it to be conditioned by an AGC circuit followed by a Schmitt trigger. The Navigation Data signal that was reformatted when the copy of the DSEA was created was of high quality and required only amplification. The Tape Time signal not having been recovered from the DSEA recording also did not require any conditioning beyond amplification.

In addition to the difficulties involved in conditioning poor quality data there was also the problem of producing a time reference or clock frequency from the recovered data. It was necessary to provide the DAS with a stable enough clock frequency to allow synchronization with the Scientific Data signal to be maintained during the 6.48 second Record in that the Scientific Data signal itself only provided timing information each 6.48 seconds. The time reference chosen is the 5.2 Khz Reference signal which unfortunately is derived from a separate oscillator in the DSEA that is not linked to

the Receiver timing. This signal frequency has a temperature dependence that is not well known and changes independent of the Receiver clock frequency. Thus the 5.2 Khz Reference frequency is multiplied by a variable multiplier between 1.500 and 2.500 to produce the system clock with a nominal frequency of 10.4 Kc. The correct multiplier is arrived at by observing with the aid of a storage oscilloscope the time as indicated by a pulse at which Frequency Frame 32 - Word I occurs, as derived from the DAS system clock, in relationship to the time at which the zero amplitude Sync Word in the Scientific Data signal occurs. When these two events occur as closely as possible in time then the multiplier is considered to be correctly adjusted. A change of .001 in the multiplier is equivalent to a 3 msec. change in timing at the end of the 6.48 second Record.

For the Lunar data, the multiplier remained constant at 1.995 from Tape Time 00:24:30 to 01:15:00 (see Figure #9). The timing over the 6.48 second Record was observed to be correct to within $\pm$ 2 msec. for this section of data. This was fortunate in that it included the most useful and significant data. After Tape Time 01:06:44 the data is of marginal usefulness because a false reset pulse (see Appendix Section F) was received by the Receiver incorrectly realigning its timing relative to the Transmitter. From time 01:15:00

to the end of the recorded data the multiplier was reduced to compensate for the degraded quality of the 5.2 Khz Reference signal.

The Navigation Data could not be demultiplexed by the DAS because of several anomolous characteristics of the data. As discussed in Section I, there are assumptions which must be made about the highest data rates allowed for the Bearing, Range and Odometer pulses in order to provide a recognizable Sync bit. For the Lunar data, there were data segments where Odometer pulses were present in 11 consecutive Navigation Data Frames. There were extra bits inserted and bits missing resulting in a Navigation Data Frame that was shorter or longer than 78.75 msec. by 11.25 msec. Also the Sync bit was sometimes a "0" when it should have been a "1".

To extract the Navigation Data the DAS operated in a mode discussed in Section III in which the Scientific Data was ignored and the undemultiplexed Navigation Data bit stream was recorded directly on magnetic tape and was provided to the Wang 720C. The data for Tape Time 00:24:30 - 01:38:00 were demultiplexed using the Wang 720C in a data reduction procedure outlined in Section (B) of the Appendix. The data recorded on the digital magnetic tape were demultiplexed using the same approach; however, the data were only demultiplexed for Tape Time 00:24:30 - 01:07:00 (Time of

false reset pulse) to provide Navigation Data for the useful segment of Scientific Data. Section B of the Appendix contains the Navigation Data for the Complete EVA-II traverse from the SEP transmitter site to Station #2.

There were four digital tapes used in the processing of the Scientific Data that were produced by the methods outlined earlier in this section. The corresponding Tape Times and other system constants used for these digitizations are given in Figure #10. Tape Time 00:24:30 corresponds to the SEP transmitter site at the beginning of EVA-II, and 01:40:00 corresponds to the time of arrival at Station #2. The "Missing Records" are the 6.48 second record segments that are lost because of a loss of synchronization between the Scientific Data signal and the DAS timing.

All the SEP Lunar data recorded during the mission is contained in the data segment of Tape Time 00:23:21 - 02:12:04. The section 00:23:21 - 01:41:12 corresponds to the traverse from the SEP transmitter site to Station #2. The section 01:41:12 - 02:12:04 corresponds to the traverse from Station #4 to #5.

The data relevant to the Station #4 to #5 traverse has not been digitized because the data is seriously degraded. It was not considered to be worth a large expenditure of effort to recover this data that is of little significance because for this data segment the relative

timing of the Transmitter and Receiver is not known. This data is discussed in more detail in Sections C and D of the Appendix.

There are several sources of error that need to be considered when assessing the accuracy of the digitization process: (a) The accuracy of the DAS in measuring the period of the 5.2 Khz Reference signal frequency and the period of the Scientific Data signal frequency; (b) Inexact synchronization between the Scientific Data and the DAS resulting in the incorrect Word being sampled; (c) Dropouts in the Scientific Data signal of the 5.2 Khz Reference signal resulting in erroneous measurements of their frequency.

For (a) the largest error which can occur for the Lunar data is $\pm$ .1 db. The effect of (b) cannot be assessed directly but by minimizing the timing in accuracies at the end of the 6.48 second Record the error can be avoided. The timing errors for the important segment of data 00:24:30 - 01:06:44 were on the order of $\pm$ 2 msec., making this error unimportant. The effect of (c) can be reduced by the appropriate adjustments of the conditioning circuitry that results in the fewest number of dropouts.

Another method for assessing the accuracy is to measure the repeatability of the measurements for different digitization. This has been done for SEP 402 and 403 and these results are included in Section E of the Appendix.

FIG.1 RECORDING OF SEP. DATA

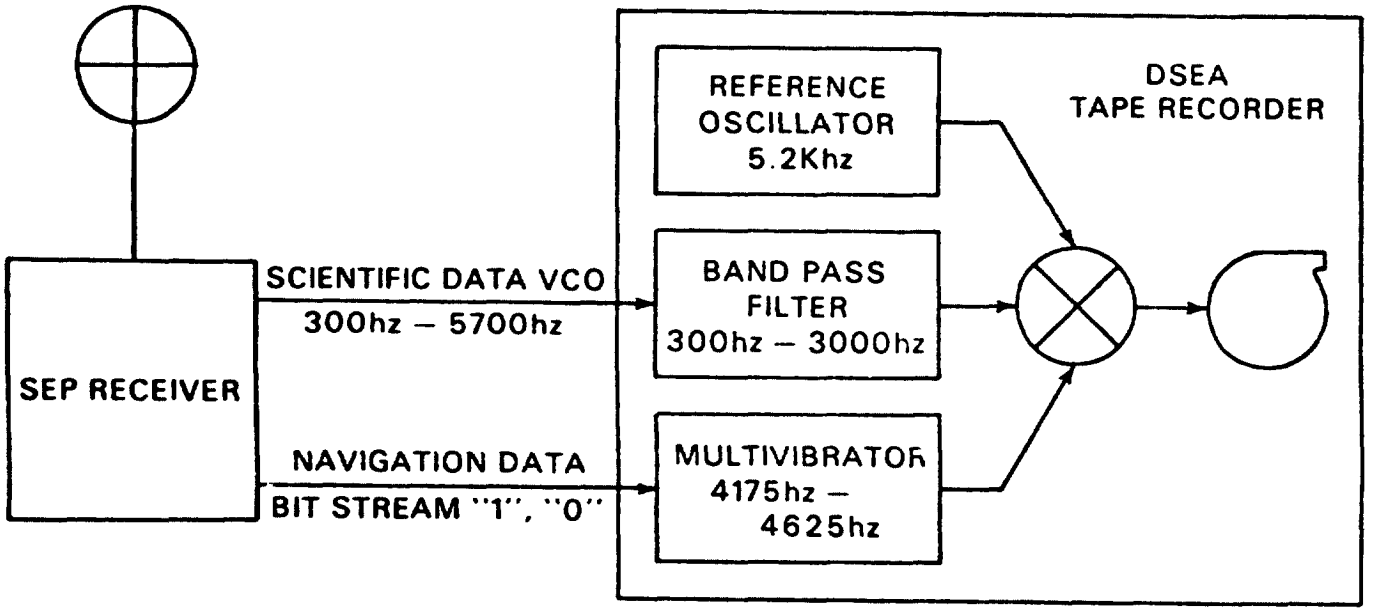
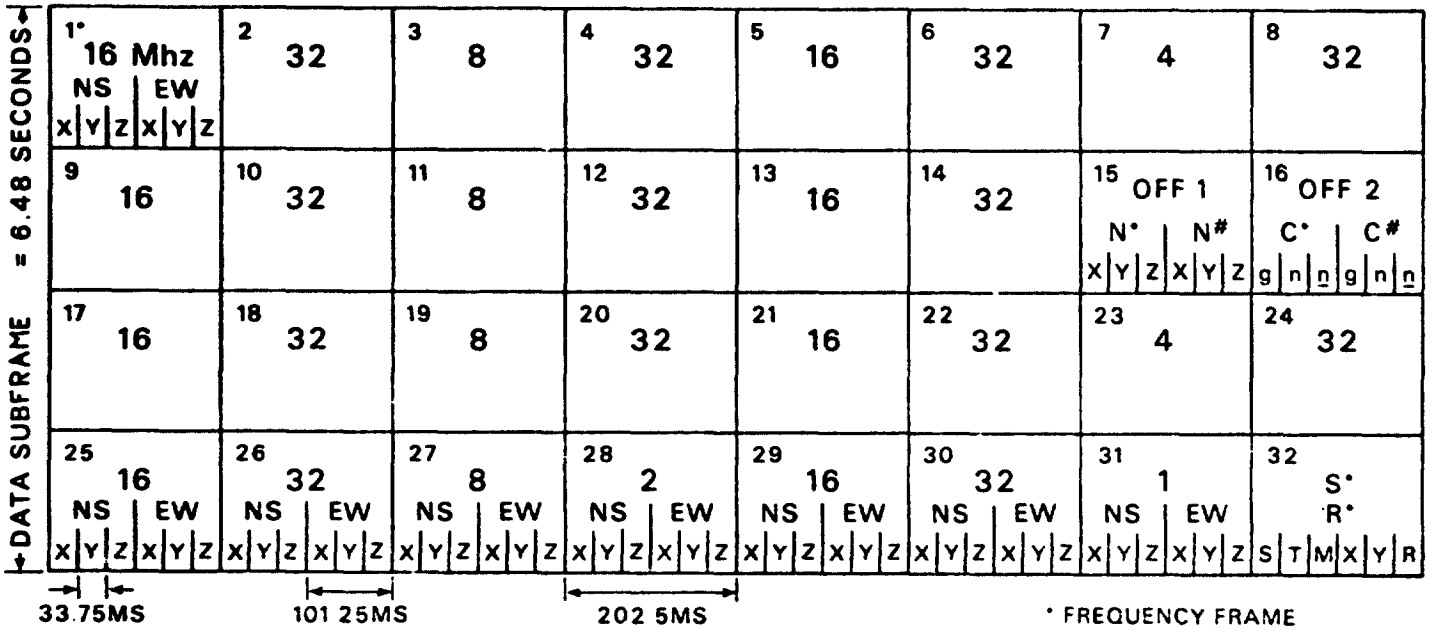


Fig. 2a Scientific Data Format



DATA SUBFRAME = 6.48 SECONDS ($S_1, \ldots S_6$) DATA FRAME = 6 x 6.48 = 38.4 SECONDS

S_1 SUBFRAME WITH	S* = NS	R* = X	N* = 32	N# = 16	C* = 32	C# = 16
S_2	= EW	= Y	= 8	= 4	= 8	= 4
S_3	= NS	= Z	= 2	= 1	= 2	= 1
S_4	= EW	= X	= 32	= 16	= 32	= 16
S_5	= NS	= Y	= 8	= 4	= 8	= 4
S_6	= EW	= Z	= 2	= 1	= 2	= 1

S – SYNC
T – TEMPERATURE
M – MODE
R – RESET

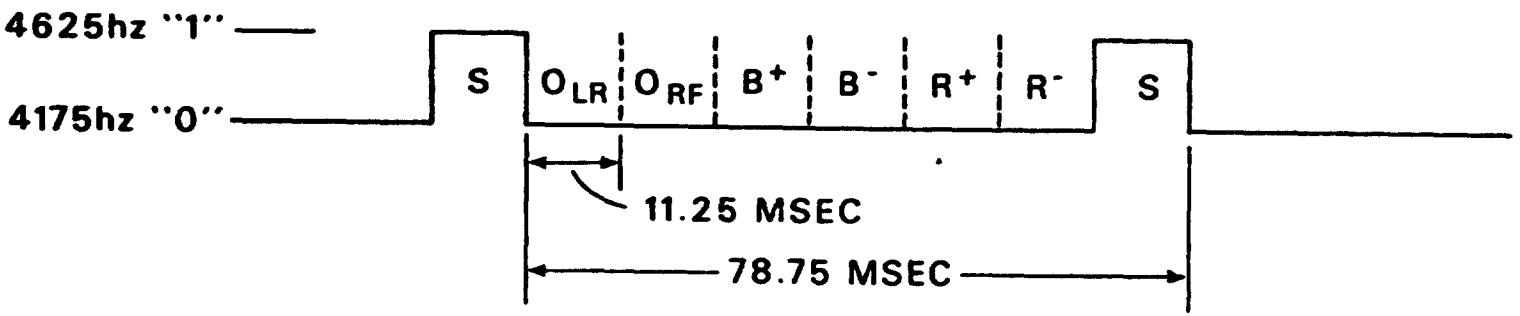
NS – NORTH-SOUTH TRANSMITTING ANTENNA
EW – EAST-WEST TRANSMITTING ANTENNA
X, Y, Z – RECEIVING ANTENNAS
g – RECEIVER FRONT END NOISE
n – NOISE SOURCE
n̲ – NOISE SOURCE + 20 db

AMPLITUDE LEVEL OF RECOVERED VCO SIGNAL						RECEIVER STATUS
S	T	M	X	Y	R	
0	1	0	0	1	0	MODE I, X-ANT ON, Y-ANT-OFF, Z-ANT-OFF, NO RESET
0	1	0	1	0	0	MODE I, X-ANT OFF, Y-ANT-ON, Z-ANT-OFF, NO RESET
0	1	0	1	1	0	MODE I, X-ANT OFF, Y-ANT-OFF, Z-ANT-ON, NO RESET
0	1	1	0	1	1	MODE II, Z-ANT ON, Y-ANT-OFF, Z-ANT-OFF, RESET, CAL 32, 16
0	1	1	1	0	1	MODE II, X-ANT OFF, Y-ANT-ON, Z-ANT-OFF, RESET, CAL 8, 4
0	1	1	1	1	1	MODE II, X-ANT OFF, Y-ANT-OFF, Z-ANT-ON, RESET, CAL 2,1
0	1	1	0	1	0	MODE II, X-ANT ON, Y-ANT-OFF, Z-ANT-OFF, NO RESET, CAL 32, 16
0	1	1	1	0	0	MODE II, X-ANT OFF, Y-ANT-ON, Z-ANT-OFF, NO RESET, CAL 8, 4
0	1	1	1	1	0	MODE II, X-ANT OFF, Y-ANT-OFF, Z-ANT-ON, NO RESET, CAL 2, 1
0	1	0	0	0	1	FIRST SYNC CODE RECOGNITION, MODE II NEXT FRAME

0 = LOW AMPLITUDE
1 = HIGH AMPLITUDE
S - SUBFRAME INDICATOR
T - TEMPERATURE PROPORTIONAL TO FREQUENCY
M - MODE
X,Y,Z - ANTENNA
R - RESET

SCIENTIFIC DATA FORMAT FIG. 2(B)

FIG. 3 NAVIGATION DATA FORMAT



S – SYNC PULSE

O_{LR} – LEFT REAR WHEEL PULSE

O_{RF} – RIGHT FRONT WHEEL PULSE

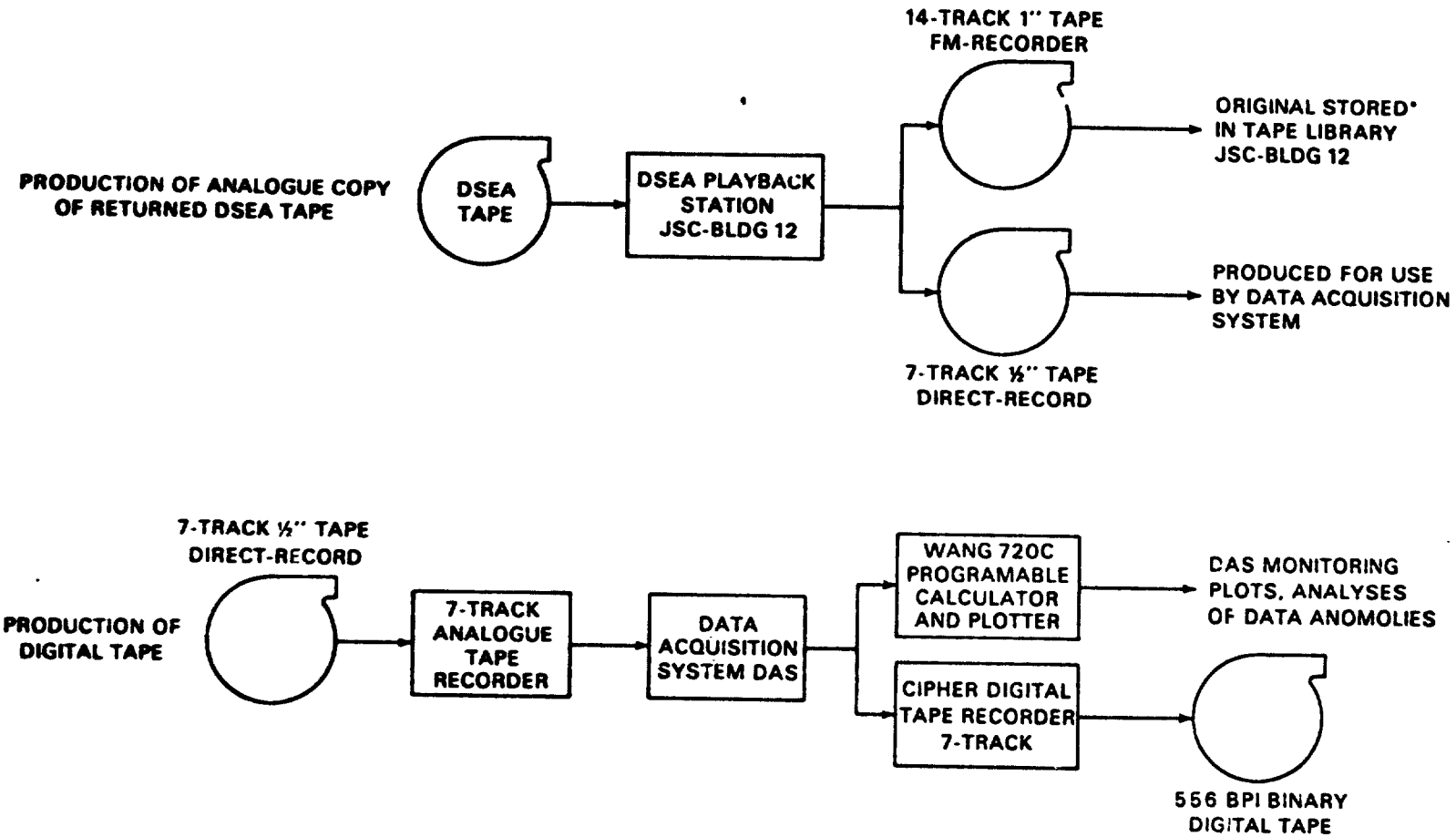
B^+ – BEARING UP 1° INCREMENT

B^- – BEARING DOWN 1° DECREMENT

R^+ – RANGE UP .1 Km INCREMENT

R^- – RANGE DOWN .1 Km DECREMENT

FIG. 4 SEP DATA REDUCTION PROCESS



*OPERAT MODE TAPE # { 96-00206
96-00207

TEST MODE TAPE # 96-00307

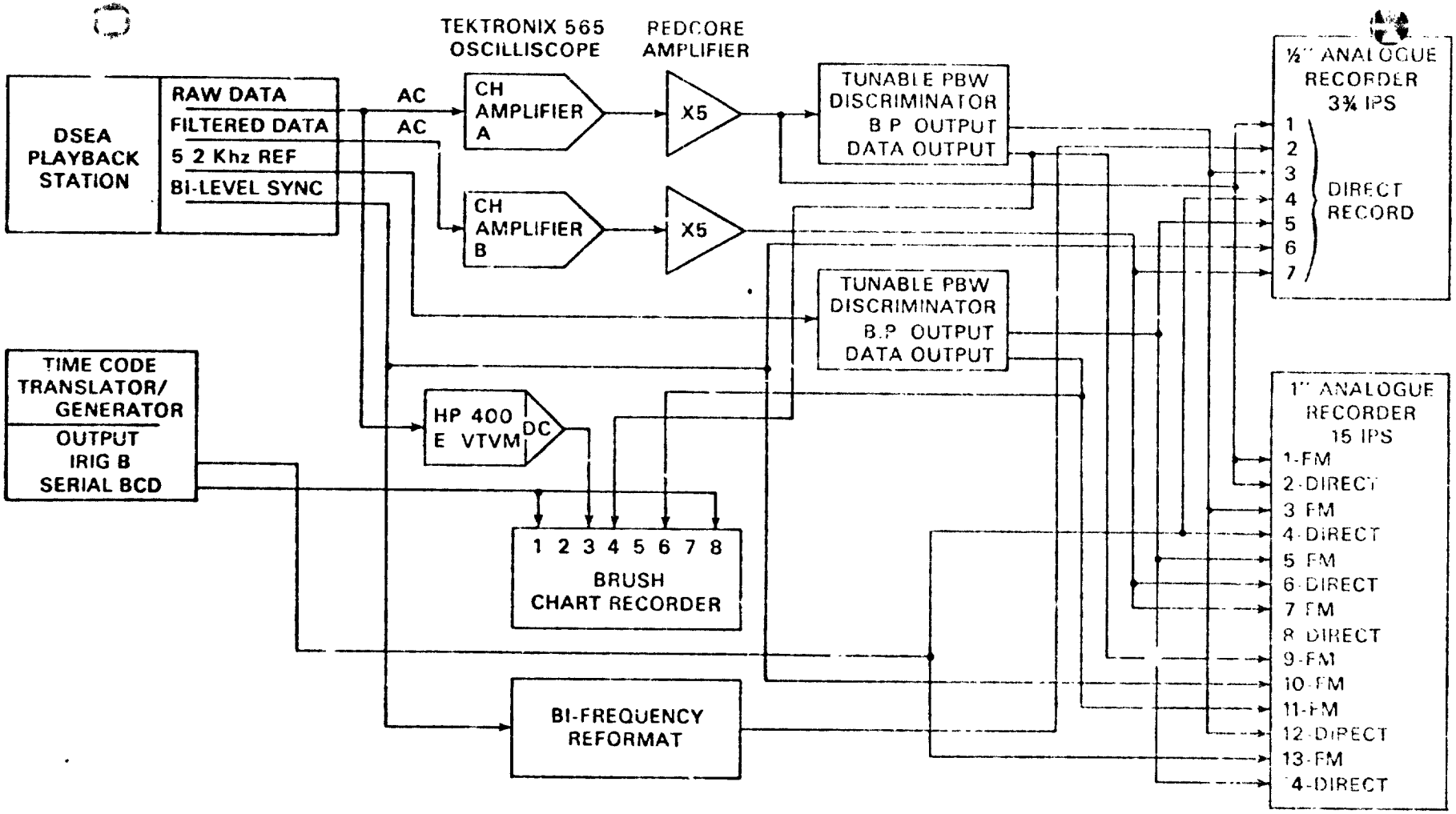


FIG. 5 PRODUCTION OF ANALOGUE COPY OF DSEA TAPE

FIG. 6 SEP DATA ACQUISITION SYSTEM

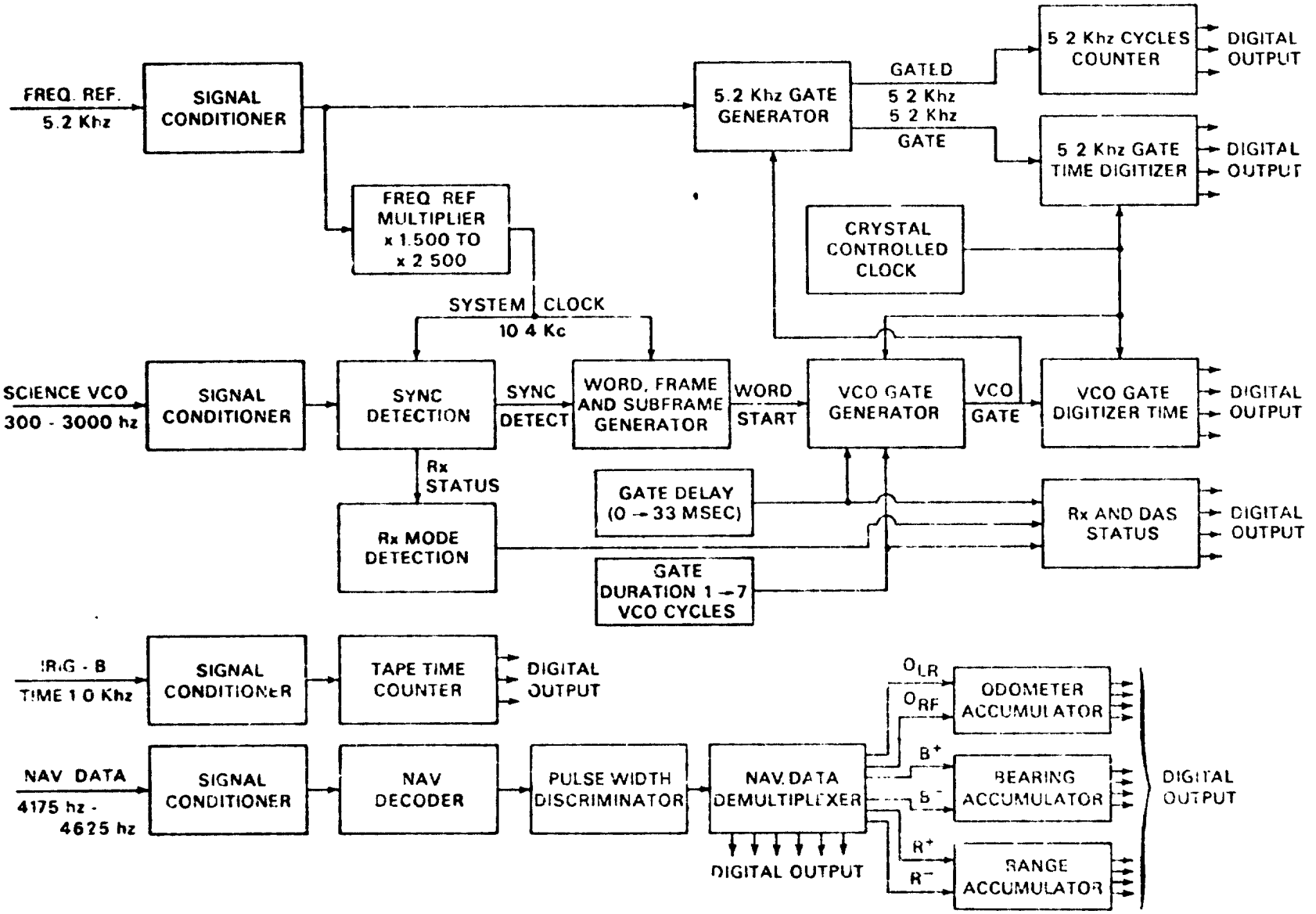


Figure 7. Digital Data Format on Magnetic Tape

Magnetic Tape Tracks

	B	A	8	4	2	1		
V_2	0	0	X	X	X	X	V_2	Period of M VCO Cycles
V_3							V_3	
V_4							V_4	
R_1							R_1	Period of N 5.2 khz Cycles
R_2							R_2	
R_3							R_3	
N_1							N_1	N 5.2 khz Cycles
N_2							N_2	
N_3							N_3	
R_4							R_4	Period of N 5.2 khz Cycles
V_1							V_1	Period of M VCO Cycles
V_5			↓	↓	↓	↓	V_5	" " " "

VCO Period = V_1 V_2 V_3 V_4 V_5 X 1μsec (or 10μsec)

5.2 khz Period = R_1 R_2 R_3 R_4 X 1μsec (or 10μsec)

5.2 khz Cycles = N_1 N_2 N_3

The above data is repeated 188 times each record

X	X	X	X	R_1	Accumulated Range
				R_2	Range = R_1 R_2 R_3 X .1 km
				R_3	
				B_1	Accumulated Bearing
				B_2	Bearing = B_1 B_2 B_3 X 1°
↓	↓	↓	↓	B_3	

0	0	X	X	X	X	O_1
		X	X	X	X	O_2
		X	X	X	X	O_3
		X	X	X	X	O_4
		X	X	X	X	O_5
		X	X	X	X	O_6
		X	X	X	X	G
		X	X	X	X	D_1
		X	X	X	X	D_2
		X	X	X	X	J_1
		X	X	X	X	J_2
		X	X	X	X	S
		X	X	X	X	T_1
		X	X	X	X	T_2
		X	X	X	X	T_3
		X	X	X	X	X
		X	X	X	X	C
		0	$\bar{y}$	$\bar{X}$	$\bar{M}$	M

Accumulated odometer counts from left rear or right front wheel

Distance travelled = O_1 O_2 O_3 O_4 O_5 O_6 X .49met.

Gate duration - M VCO Cycles

Gate delay = D_1 D_2 msec.

Run # = J_1 J_2

DAS sync status

Time accumulator = T_1 T_2 T_3 X .1 sec.

Wang 720 sync word

Receiver status-reset

Receiver status-mode (see Figure 2(B))

For the preceding data: Track A & B are always "0"
Track C (not shown) is lateral
Odd parity bit generated internally by recorder
Track 8, 4, 2, 1 comprise BCD digit.

B	A	8	4	2	1		
ORF	OLR	B^-	B+	R^-	R+		Navigation data 6 bit word repeated 195 times each record
0	0	X	X	X	X	U_1	Total navigation date updates in record = U_1 U_2 U_3
0	0	X	X	X	X	U_2	
0	0	X	X	X	X	U_3	

IRG

Each record contains 2478 BYTES

FIG. 8 LUNAR DATA DIGITIZATION SYSTEM CONFIGURATION

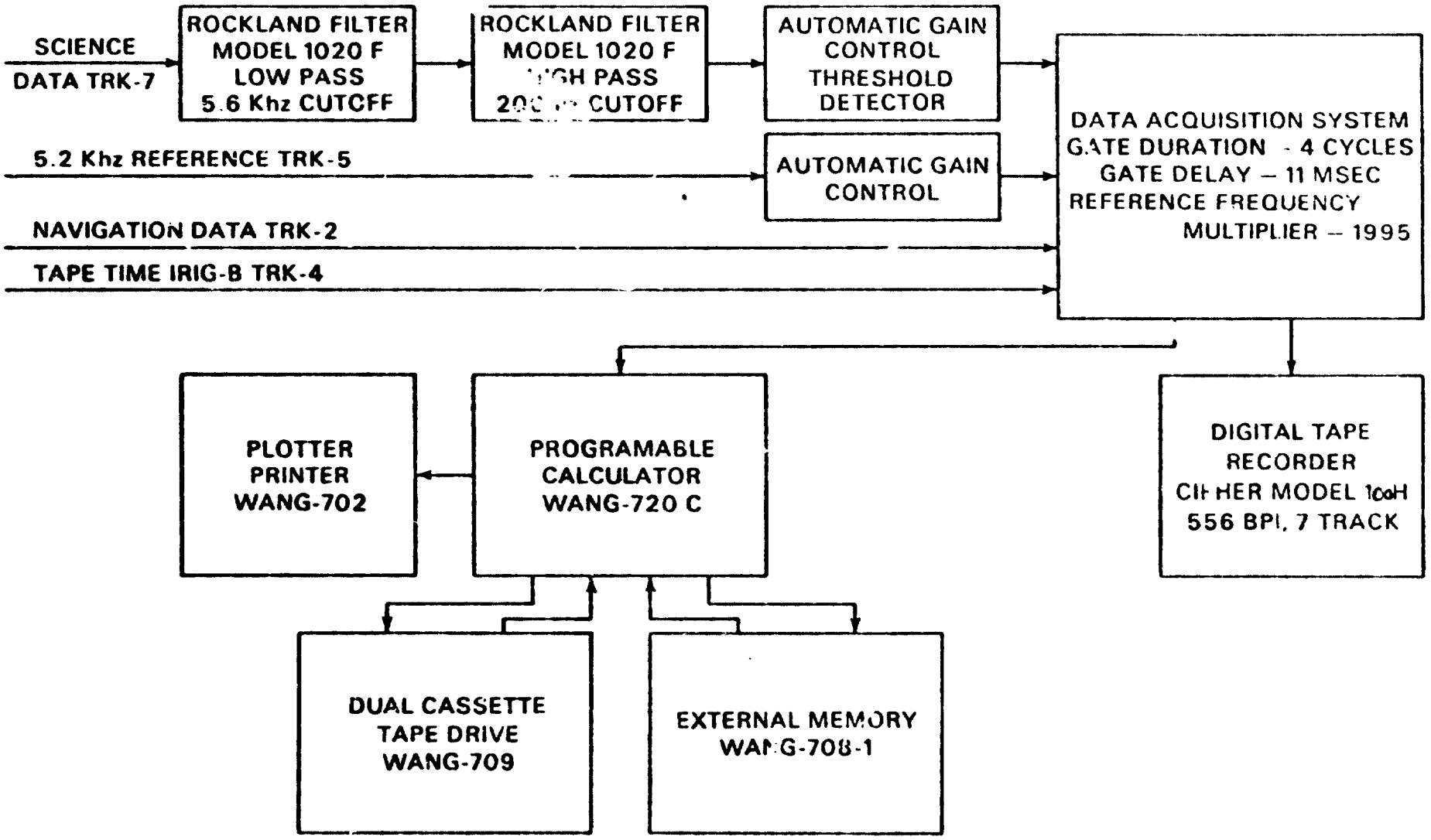


FIG. 9 DAS FREQUENCY MULTIPLIER

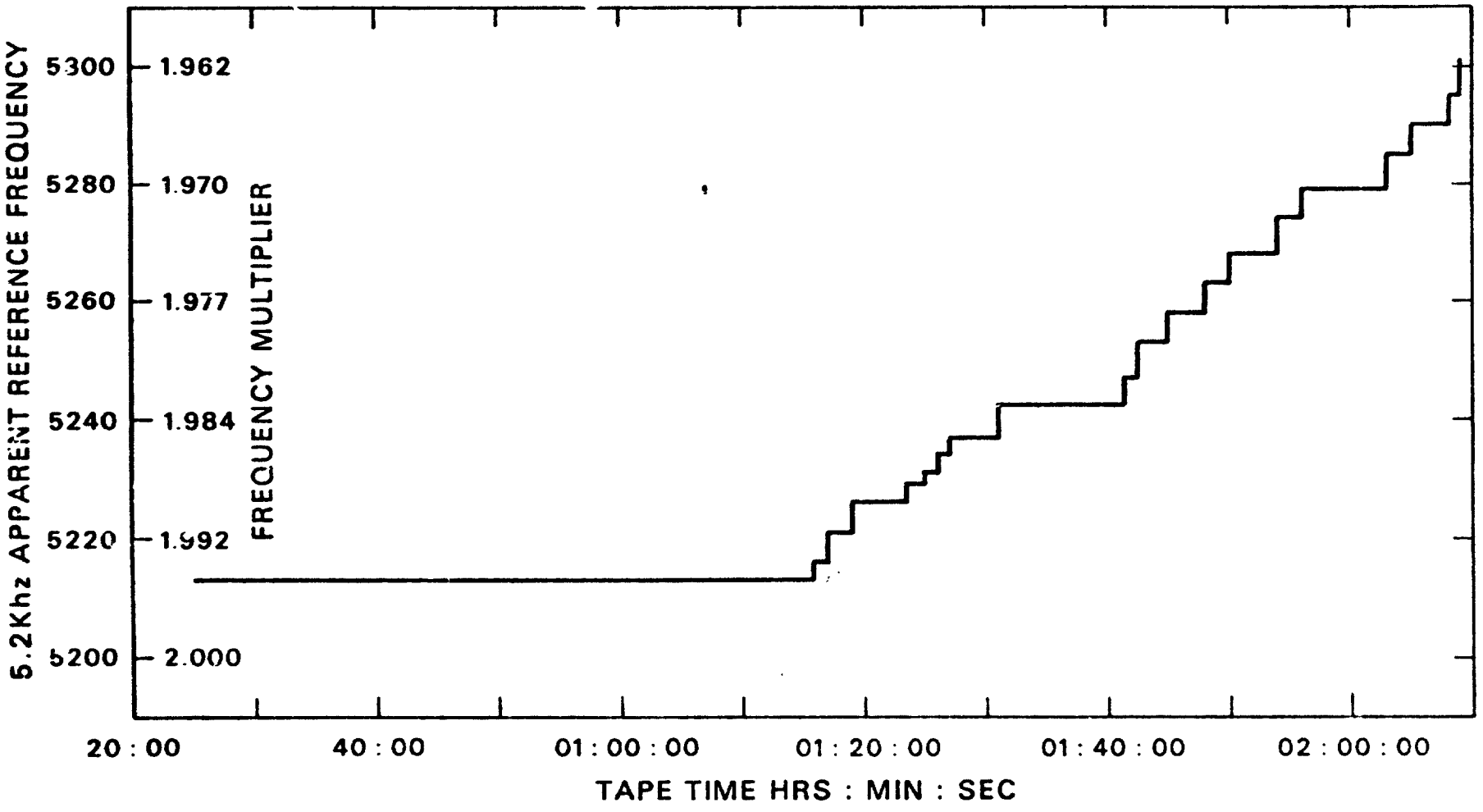


Figure 10. Scientific Data Digital Tapes

Digital Tape	SEP 400	SEP 401	SEP 402	SEP 403
Start Tape Time	00:24:30	00:24:30	00:24:30	00:24:30
End Tape Time	01:08:00	01:40:00	01:40:00	01:40:00
Gate Duration (Cycles)	5	5	5	5
Gate Delay (msec)	11	11	11	11
Missing Records	0	3	0	0
Tape Time of Lost Records	-	01:32:00	-	-

APPENDIX A

DRC TELEMETRY OPERATIONS PROCEDURE

1.0 Scope

This procedure describes the background, methods, and requirements for playback of the Data Storage Electronics Assembly (DSEA) tape magazine as utilized in the Lunar Surface Electrical Properties (LSEP) experiment, and for producing a master copy and working copies of the original tape.

1.1 General

The DSEA is to be utilized to record data sensed by the Lunar Surface Electrical Properties package placed on the lunar surface. The DSEA has a record speed of 0.6 inches per second. Although four tracks are available on the tape, only one is recorded at a time. This single channel will have three items of information frequency multiplexed which must be recovered. These are: (1) the VCO signal frequencies; (2) the FSK synchronization information; and (3) the 5.2 KHz clock.

1.2 Processing Requirement

Six different tests of the DSEA recorder are scheduled in connection with the LSEP experiment of Apollo 17. The test tape from the recorder used during these experiments is to be dubbed onto two new tapes: one a 1", 14 track master copy, and the other a 1/2", 7 track working copy for use by the Principal Investigator.

1.2.1 The master copy must contain:

- o Raw data - all information contained on the tape
- o Filtered data - the information contained in a band of frequencies from 300 - 3 KHz
- o Frequency sync - a FSK (frequency shift keyed) modulated carrier moving between 4175 and 4625 Hz
- o Bi-Level sync - the demodulated form of frequency sync (output by DSEA station).
- o 5.2 KHz - the 5.2 KHz clock (output from DSEA).
- o IRIG B - locally generated time
- o 25.0 KHz - reference frequency at 15 IPS (Internal to FR 1800II).
- o Discriminated Frequency Sync - bi-level sync generated by an external discriminator.
- o Discriminated 5.2 Hz - a signal showing the frequency variations in the clock.
- o Voice annotation - for use when needed.

.2.2 The 1/2" working copy must contain:

- o Raw data
- o Filtered data
- o IRIG B time
- o Frequency sync (4175 - 4625 and bi-level)
- o 5.2 KHz

.2.3 An additional requirement involves the use of an 8-trace Brush recorder to provide quality monitoring and verification information during the dubbing process. Recorded on the Brush will be:

- o RMS amplitude of the raw data
- o Discriminated frequency sync
- o Discriminated 5.2 KHz
- o Time in slow code.

.2.4 Track Assignments

The 1" wide band tape machine shall be used to record data at a tape speed of 15 IPS according to the following schedule. The tape unit direct recorded frequency response is 400 Hz to 187 KHz; the FM frequency response is DC to 50 KHz.

Track	Information	Type of Recording
1	Raw data	FM
2	Raw data	Direct
3	Freq. Sync	FM
4	IRIG B	Direct
5	5.2 KHz	FM
6	Filtered data	Direct
7	Filtered data	FM
8	3.125 KHz	Direct
9	Discriminated Frequency Sync	FM
10	Bi-level Sync	FM
11	Discriminated 5.2 KHz	FM
12	Freq. Sync	Direct
~~13~~	~~Voice Annotation~~	~~Direct~~ Time FM
14	5.2 KHz	Direct

.2.4.2 The 1/2" tape machine shall be used to record data at a tape speed of 3 3/4 IPS according to the following

schedule. IRIG intermediate band heads and electronics shall be used. The tape unit direct recorded frequency response is 100 Hz to 15 KHz.

Track	Information	Type of Recording
1	Raw data	Direct
2	Reformatted 4175-4625 Hz	Direct
3	Freq. Sync	Direct
4	IRIG B	Direct
5	5.2 KHz	Direct
6	Bi-Level Sync	Direct
7	Filtered data	Direct

.4.3 The Brush trace assignments are as follows with DC to 50 Hz frequency response.

Trace	Information
1	Slow Code
3	RMS Amplitude of Raw data
4	Discriminated Freq. Sync
6	Discriminated 5.2 KHz
8	Slow Code

Applicable Documents

- Work Request
- Interdepartmental Communication, 72-SRS-005, "Lunar Roving Vehicle DSEA and Support Requirements."
- Support Manual Data for Test Station, IRIG B, DSEA; Leach Corporation, Controls Division, Azusa, California
- Loading Procedure, DSEA Tape Magazine; LEC Systems Engineering Operating Procedure DRC-017.
- Memo 72-SRS-110, to J. M. Randal from K. J. Langenberg, Subject: Revisions to Operating Procedure DRC 021, dated 8/7/72.

Data Processing Hardware (or equivalent) Required

- Leach Corp., Test Station Data Storage Electronics Assy., P/N 11-08225, S/N 005, Unit TS-5.
- Astrodata Time Code System, Model 6270 with Slow Code Generator.
- Two EMR 4142 PBW Tunable Discriminators

REPRODUCIBILITY OF THE
ORIGINAL PAGE IS POOR

- o Hewlett Packard 400E AC Voltmeter (DC output)
- o Two Redcore 500 Amplifiers
- o Brush Recorder Mark 200
- o Hewlett Packard 651B Test Oscillator
- o Ampex FR 1800 or FR 1400/600 Intermediate Band Seven Track Tape Recorder
- o Ampex FR 1800 Wide Band Fourteen Track Tape Recorder
- o Eldorado Electronics Model 10 Universal Counter with Model 1000 Totalizer
- o Tektronix RM 565 with 3A6 or 3A1 Vertical Amplifiers

3.1 Tape Required

- o For 1" machine use 14" reels of 1 mil wideband tape.
- o For 1/2" machine use 14" reels wound with standard band tape supplied by customer. Use standard band heads on machine.

4.0 Procedure

4.1 Work Request

The procedures prescribed herein are based on stated requirments for the data to be produced, check the work request carefully to assure agreement between these two documents. Refer questions to shift supervision. Resolve discrepancie and obtain any procedural changes before commencing.

4.2 DSEA Tape Handling

Immediately upon receipt, the condition of the tape and reel and container shall be documented in writing. Further conditions noted during playback shall be documented in writing. Discrepancies such as poor pack, edge curl, oxide shed, stretched, no data, bad data and other pertinent comments must be written down at the time they are discovered. If the tape is damaged during processing, it must be documented. Do not continue this procedure if the tape is damaged when received until instructed to do so by supervision. The condition must be reported and approval to proceed received from Requirements and Analysis before processing further. Handle the tape carefully.

REPRODUCIBILITY OF THE
ORIGINAL PAGE IS POOR

Protect it from contamination and stray magnetic fields. Do not load the magazine on the DSEA playback station until called for in the procedure. Do not load the tape on a malfunctioning playback station. Stop operations immediately if the magazine or the playback station malfunctions during processing.

4.3 DSEA Setup

Configure the Off-Line equipment as shown in Figure 1. The DSEA tape will be reproduced in the closed servo loop mode only. This is accomplished by placing the test switch S1 located on the top rear of the playback assembly in the operate position. Next, the speed of the DSEA playback assembly will be measured by counting the frequency at Test Point 11. It should be 1100 + 1 Hz. If the frequency is incorrect, adjust R10 on the Amplifier, DC Servo Control Board, Location A14, in the Playback Assembly. Use Bi-Frequency Reformat Box as shown.

4.3.1 Configure the two discriminators as follows:

	Discriminator #1	Discriminator #2
Frequency	4400 Hz	5200 Hz
Data Cutoff	300 Hz	100 Hz
Balance	Mid Position	Mid Position
Deviation	7.5%	7.5%
Polarity	+	+
Bandedge set	75% CW	75% CW

Note that the 24 db/octave tunable input filter is used to band pass the FSK and Reference signals with signal outputs taken at the BP Out Test point. The normal Discr. output connector is used for discriminated data.

4.3.2 Set the Tektronix Vertical Amplifiers to 0.5 v/cm (calibrated). Set the raw data Redcore Amplifier to X10 gain, 10 KC BW. Set the filtered data Redcore Amplifier to X5 gain, 10 KC BW.

4.3.3 Set the RMS Voltmeter to 0.3 volt full scale.

4.3.4 Set the signal generator to 25.0 KHz ± 1 Hz output voltage -2 volts peak-to-peak.

4.3.5 Set the Brush recorder speed to 5mm/sec.

4.5.3 Perform adjustments on the record modules in the two recording machines. The center frequency of the wide-band GP II FM modules shall be 112.50 KHz. The deviation for + 1 volt input shall be + 30%. Check the quality of the recording with properly adjusted reproduce modules. Insure that the recording levels of the direct record modules are not so high as to saturate either the module circuitry or the magnetic tape itself.

4.5.4 Stop all three machines, rewind all tapes. Unload and degauss the 1" and 1/2" tapes. Reload tapes on machines.

4.6 Begin dubbing by starting 1" and 1/2" machines, then start the DSEA and time generators.

4.6.1 The 1/2" machine will not be able to continuously record all of the DSEA data. Thus, whenever the 1/2" machine runs out of tape, the DSEA tape and time generator will be stopped The 1" machine will be stopped and then advanced for one minute without recording. When the 1/2" machine has been reloaded with fresh tape, all three machines and the time generator will be started simultaneously.

4.6.2 In like manner, when the 1" machine runs out of tape, the DSEA, time generator, and 1/2" machines shall be stopped; the 1/2" machine advanced 1 minute, the 1" machine loaded with fresh tape, and all three machines and time generator restarted simultaneously.

4.7 Verification of a master tape, which is up to 10 hours long, would be too time consuming to do after the dubbing process is complete. It is the duty of the operator to check the reproduced information as the dubbing process is in progress. Check all 14 tracks of the 1" machine and the 7 tracks of the 1/2" machine every 15 minutes to insure all tracks are being recorded. Once the dubbing process is started, do not change any settings unless the data obviously becomes useless. If an equipment configuration change becomes necessary, stop all the machines, make the necessary adjustments, annotate the tape on the voice track describing what was done and continue dubbing. Document the configuration change on the work order.

4.8 It is important that the output jacks (except bi-level sync) of the DSEA test station not be loaded with low impedance devices particularly tape recorder inputs. For this reason the equipment setup is such that there are buffer amplifiers between the outputs of the DSEA and the inputs of the tape recorders. Also, the output voltage levels usually require amplification to adequately drive a tape recorder input.

REPRODUCIBILITY OF THE
ORIGINAL PAGE IS POOR

4.3.6 Set the speed of the 1" tape recorder to 15 IPS and the 1/2" tape recorder to 3 3/4 IPS.

4.3.7 Set the time generator to internal generate, IRIG B output. Slow code generator - 5 sec. update.

4.4 Initial Adjustments

4.4.1 Load the DSEA magazine into the playback assembly of the DSEA test station.

4.4.2 Press TAPE LOAD DSEA - this will rewind the magazine to its start point. When the end of tape marker is reached, the tape direction will reverse, then stop.

4.4.3 Press REAL TIME; when data is received, proceed to make the following adjustments.

4.4.4 Adjust the RAW DATA Tektronix Amplifier for an output offset of 0 v.

4.4.5 Adjust the filtered data Tektronix Amplifier for an output offset of 0 volts.

4.5 Initial Calibrations

4.5.1 Set the bandedge adjust control of both discriminators to full CW. Stop the DSEA tape.

4.5.2 Calibrate the Brush recorder such that the pens take the following positions: (Use a signal generator)

Trace 3

Voltage Input to RMS Meter	Trace Position
0.3 V	3 divisions from right
~~0.5 V~~	middle
0V	full right

Trace 4 (Reversed)

Frequency Input to Freq. Sync Discr.	Trace Position
4100 Hz	3 divisions to the left from middle
4400 Hz	middle
4700 Hz	3 divisions to the right from middle

Trace 6 (Reversed)

Frequency Input to 5200 Hz Discr	Trace Position
4900 Hz	full left
5200 Hz	middle
5500 Hz	full right

Trace 1-8

Adjust peak-to-peak travel of pen to 1/2 full scale. Center the pulsetrain.

APPENDIX B

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION
MANNED SPACECRAFT CENTER
HOUSTON, TEXAS 77058

REPLY TO ATTN OF: TN2

July 16, 1973

MEMORANDUM

TO: Distribution

FROM: J. D. Redman

SUBJECT: Reduction and Analyses of SEP Navigation Data

In a previous memo of April 17, 1973, "Analyses of SEP-LRV Navigation Data," there was a dicussion of the recovered navigation data for the EVA-II traverse from the SEP transmitter site out to a range of 4.0 Km. The data has now been recovered for the complete traverse from the SEP site to station #2. This has been a tedious process necessitating the use of strip charts of the raw data from which hand counts of the updates could be made. Some minor errors in the digitization and reduction of the data have been uncovered which affected the odometer and bearing data. These problems have been corrected and the tabulated navigation data and enclosed figures reflect these changes.

Method of Data Reduction

For the data that is discussed in this memo, a Wang 720 calculator was used for demultiplexing and editing the raw data. This process has also been carried out by Ray Watts on the Univac 1108 computer to produce an edited digital computer tape. The Wang 720 calculator has the advantage of allowing more operator interaction resulting in a faster arrival at the optimum acquisition system configuration in the sense of producing data with the number of errors minimized.

The original navigation data bit stream is decoded and filtered by the DAS (Data Acquisition System). The conditioned bit stream is then passed to the Wang 720 calculator where it is written on Wang digital cassette tapes. This tape is then read and demultiplexed by the Wang. The data for each 6.48 sec. record is tested to locate the position of the sync bit which should occur every 7th bit time. If the sync bit cannot be located then that record is printed out allowing the problem to be visually analysed. There are three types of errors which occur. An extra bit (i.e., 11.25 msec of time) may be inserted somewhere in the record. A bit may be missing and a sync bit may be a "0" where it should be a "1". This failure is then corrected by inserting or deleting a bit or by changing a "0" bit to a "1" bit. The sync bit is then relocated.

With the position of the snyc bit known, the data for that record is then demultiplexed in terms of range, bearing and odometer pulses and written on a digital cassette tape. This tape is used to produce a tabulation of all the range, and bearing pulses and the time at which they occur in terms of their update number. In order to compare the data on the strip charts and the demultiplexed data it was necessary to correlate in time individual navigation data words (73.75 msec words). The reference chosen to compare these two forms of data is the position of the navigation data word in which the first odometer pulse occurs after tape time 00:25:00. This word is referred to as Nav update #1 and all others are referenced to it. There are 55,000 updates or navigation data words on the traverse from the SEP transmitter site to station #2.

A hand count of all the range up, range down, bearing up and bearing down pulses was made by visual inspection of the strip charts of the raw data for the complete traverse. In the last section of the data (last 5000 updates) it was not possible to do a hand count with any confidence in the results because of numerous data dropouts.

The tabulated range and bearing pulses recovered with the DAS and Wang were compared with those found by visual inspection of the raw data. Out to a range of 4.6 Km there was only one discrepancy in which an extra bearing down pulse occurred and was attributed to noise in the raw data. From the range of 4.6 Km out to Station #2 the data steadily degrades in quality. There are numerous bits missing and sync bits which are a "0" where they should be "1"'s. There were 53 discreparcies between the hand-counts and the digitized data mainly caused by extra range up pulses occurring because of timing errors. Even though all these discrepancies occurred, the corrected data appears to be reasonably good as will be discussed later.

The Wang digital tapes which contained the demultiplexed data were edited to correct the errors that occurred during the digitization. These edited tapes were used to produce the data tabulations that are enclosed in this memo.

The data that was recorded on computer tape has gone through essentially the same process. The data has been compared to the hand counts and the errors have been corrected. The range and bearing data agree exactly with the data digitized on the Wang that is discussed in this memo. The accumulated odometer counts agree exactly out to the range of 4.3 Km.

This data was only completed out to a range of 5.7 Km because the difficulty of correcting all the errors that occurred beyond this point

was considered to be too great to warrent spending excessive time on navigation data that applied to science data that was of marginal usefulness because of the loss of syncronization between the transmitter and receiver beyond the range of 4.3 Km. This digital tape has been copied and sent to MIT.

Data Quality

One measure of data quality is a comparison between the crew readouts from the navigation system that were relayed during the mission and the final version of the data that was recovered from the DSEA after digitizing, demultiplexing and editing. These two should agree since the crew displays for range and bearing were driven by the same pulses recorded on the DSEA. For the LRV navigation system distance traveled is computed on the basis of the third slowest wheel; however, only odometer pulses from two wheels were recorded on the DSEA, therefore these two approaches to calculating the distance traveled will not agree exactly. The distance traveled as computed from each odometer value is included in table #1. This table gives a comparison between the crew readouts and the digitized data. The digitized data is taken directly from the data tabulation of table #2. It is clear that there is excellent agreement out to a range of 6.9 Km from the SEP transmitter site. Beyond this range it is apparent there is one range up pulse and one bearing up pulse missing. This fact is also clear when one examines the wander factors as given in table #3. At a range of 7.4 Km the wander factor is .314 which appears anomalous in relationship to the other values at this distance and also considering they were traveling in a straight line path in this area it is probable that a range pulse is missing between the apparent ranges of 7.3 Km and 7.4 Km. A search of the raw data recorded on the strip charts was made again in this area but presumably because of the degraded nature of the data it was not possible to find this missing pulse.

The comparison between the crew readouts and digitized data suggest that the data is of good quality out to a range of 6.9 Km from the SEP transmitter and that for the remainder of the data to station #2 there is only one range and one bearing pulse missing. This is understandable considering the quality of the recorded data was steadily degrading as the DSEA temperature approached 115°F, the upper limit of its operating range, due to thermal control problems on the traverse to station #2. It was known from tests conducted before the mission that the recording capabilities were degraded at temperatures near 110°F so this was to be expected.

The accuracy of digitization could be tested by comparing the hand-counts of the raw data against this digitized result. It was only possible to hand count the range and bearing pulses since the large number of odometer pulses would have been too time consuming to count. To test that the digitization process was reliably recovering the odometer counts, a section of the data of 1500 navigation data words in duration was hand counted for both the left rear and right front odometer pulses. There were 640 right front and 639 left rear odometer pulses in this section of data. These hand counts agreed exactly with the digitized data. As stated already in this memo there was only one discrepancy of an extra bearing down pulse attributable to an observed noise pulse on the strip charts in the section of data from the SEP transmitter site out to a range of 4.6 Km. At the range of 4.3 Km a false reset pulse occurred in the SEP receiver resetting the timing relative to the transmitter and resulting in the remainder of the field strength data out to station #2 being of dubious usefulness. Fortunately the navigation data is excellent for all of the useful scientific data. From the range of 4.6 Km out to station #2 the data steadily degrades in quality resulting in numerous digitization errors. The strip charts were used to resolve the discrepancies between the results derived by a hand count and the digitization.

Data Tabulation

In table #2 the accumulated navigation data is printed out every thirteen navigation data updates (i.e., 13 x 78.75 msec) which is a time interval of 1.02 sec. The tabulation begins at the SEP transmitter and ends at station #2. The time origin or time zero is at ground elapsed time 141:30:35. The speed is calculated by counting the number of odometer pulses that occur in each interval of 13 updates. This results in the apparent quantized values of the speed. The distance traveled at any time can be calculated by multiplying the odometer counts by .49 meters. Since the first range pulse occurs at 50 meters instead of the normal interval of 100 meters the range is computed by subtracting 50 meters from the value given for the range.

Wander Factors

An indication of the amount by which the LRV deviates from a straight line path is given by the wander factors shown in table #3. If the LRV is not moving on a ray path directly away from the SEP Tx (i.e., with the bearing remaining constant) then the wander factors also reflect this in addition to the wandering. The wander factor is computed by counting the number of odometer counts between successive range up pulses and dividing this value by 204.1. If the bearing did not change between these successive range up pulses and if the LRV moved in a straight line path between them, then there should have been 204 odometer pulses. Thus this ratio is an indication of the amount of straying from the straight line path and can be used to calculate the range for intermediate points between range updates.

Traverse Reconstruction

In figures 3, 4 and 5 a plot of the traverse derived from the navigation data is shown. The location of the SEP is assumed to be that given by USGS which is quoted as being accurate to within 10 meters. In figures 3 and 4 a point was plotted for each range up pulse. The bearing for that range value was computed by taking the average of the accumulated bearing at the time of the range up pulse and the accumulated bearing at the time of the previous range or bearing up or down pulse. In figure 5 a point was plotted for each range up pulse and each bearing up and down. The range value for each bearing point was calculated by interpolating between range up pulses with the use of the appropriate wander factor and the odometer.

Rover Speed

The LRV speed is plotted for the traverse from the SEP transmitter to station #2 in figures 1 and 2. In figures 1(a) and (b) the speed was calculated over intervals of 120 navigation data updates (i.e., every 9.45 seconds) by averaging the number of counts on the left rear and right front odometers. Their average speed is 10 Km/hr. for most of the traverse. In figure #2 the speed is computed and plotted separately for each wheel. As can be seen the values agree quite well with each other as would be expected. The crew readouts of their speed were generally in the range 9 - 11 Km/hr.

Comparison With the USGS and VLBI EVA-II Traverse Data

In table #4 the comparison between these various sources of traverse data is given for the station stops and Hole in the Wall. The VLBI data has an accuracy of approximately 40 meters. This data was transmitted verbally by I. Salzberg on July 11, 1972. The USGS traverse information was taken from a map prepared from final pan station locations which will be used in the preliminary science report. The locations of stations EP-4, LRV-1, and station 2 are estimated to be within 10 meters. For LRV-2, and LRV-3 the errors are estimated to be within 50 meters. The USGS traverse shown in figure #4 is from a combination of photographic information and the preliminary low speed VLBI data .

The station locations derived from these different sources is plotted in figure #4. From the SEP transmitter to the LRV-1 station stop there appears to be reasonable agreement between the different apparent station locations. The LRV-2 and 3 stops show disagreements on the order of 500 meters. From Hole in the Wall to station #2 the USGS traverse data shows large discrepancies with the SEP-LRV navigation data. Some of these differences can be attributed to errors in the LRV navigation system which suffers from wheel slippage, errors, gyro compass drift and other errors inherent in this type of system. A better assessment will be possible when all of the VLBI data out to Hole in the Wall is available.

This data and the digital tape that has been produced represents the complete processing of the Rover navigation data. No further work is anticipated until the final detailed ULBI data is available for comparison.

There is no plan to redigitize the science data immediately. This will be done after we have had a chance to work with the present digitization and the merging with the navigation data. Before the end of the contract the science data will be redigitized in an optimum and final form.

J. D. Redman

Enclosures

Distribution:
D. W. Strangway
R. D. Watts
Gene Simmons
R. Batson
I. Salzberg
J. Blucker
A. P. Annan
J. Groener
W. Eichelman
D. Cubley

TABLE #1: COMPARISON OF CREW READOUTS AND DIGITIZED DATA

EVA-II - SEP TX SITE TO STATION #2

Ground Elapsed Time GET	Tabulation Time Table #2 Seconds	Bearing		Range (Km)		Distance (Km)		
		Crew Readout	Digitized Data	Crew Readout	Digitized Data	Crew Readout	Digitized Data O_{RF} *	Digitized Data O_{LR}*
141:35:45	[illegible]	83	83	.5	.5	.6	.58	.53
141:42:49	734	83	83	1.0	1.0	1.2	1.13	1.14
141:45:39	904	81	81	1.4	1.4	1.6	1.55	1.57
141:49:44	1149	78	78	2.0	2.0	2.3	2.21	2.22
141:54:34	1439	82	82	2.6	2.6	3.0/3.2	2.93	2.96
141:58:00	1645		82	2.9	2.9	3.5	3.23	3.23
142:03:[illegible]	2104+	83	83	3.8	3.8	4.4	4.27	4.31
142:[illegible]	2431+	82	82	4.3	4.3	5.0	4.85	4.90
142:[illegible]	[illegible]5	82	82	4.9	4.9		5.49	5.55
142:24:07	3152	81	81	5.6	5.6		6.25	6.32
142:24:49	3254	81	81	5.7	5.7	6.7?	6.45	6.52
142:29:53	3558	78	78	6.2	6.2	7.2	7.08	7.17
142:32:19	3704		78	6.5	6.5	7.8	7.41	7.51
142:33:34	3779	77	77	6.6	6.6	7.9	7.57	7.68
142:36:40?	3965		74	6.9	6.9		8.08	8.19
142:41:09	4234	71	70	7.4	7.3	8.9	8.70	8.82
142:43.24	4369+	71	70	7.6	7.5	9.1	8.95	9.08

*Computed from odometer counts

+LRV at stop

TABLE #2 EVA-II NAVIGATION DATA TABULATION

TIME SEC.	R+ CNTS	R- CNTS	TOTAL R CNTS	B+ CNTS	B- CNTS	TOTAL B CNTS	ORF CNTS	OLR CNTS	SPEED-RF KM/HR.	SPEED-LF KM/HR.
1.0									.0	.0
2.0									.0	.0
3.1									.0	.0
4.1									.0	.0
5.1									.0	.0
6.1									.0	.0
7.2			SEP TX						.0	.0
8.2									.0	.0
9.2									.0	.0
10.2									.0	.0
11.3									.0	.0
12.3									.0	.0
13.3									.0	.0
14.3							2		3.4	.0
15.4							2		.0	.0
16.4							2		.0	.0
17.4							2		.0	.0
18.4							2		.0	.0
19.5							2		.0	.0
20.5							2		.0	.0
21.5							3		1.7	.0
22.5							3		.0	.0
23.5							4		1.7	.0
24.6							4	1	.0	1.7
25.6							4	1	.0	.0
26.6							5	1	1.7	.0
27.6							5	1	.0	.0
28.7							6	1	1.7	.0
29.7							6	2	.0	1.7
30.7							6	2	.0	.0
31.7							7	2	1.7	.0
32.8							8	3	1.7	1.7
33.8							8	4	.0	1.7
34.8							10	5	3.4	1.7
35.8							11	6	1.7	1.7
36.9							12	7	1.7	1.7
37.9							13	9	1.7	3.4
38.9							15	10	3.4	1.7
39.9							16	12	1.7	3.4
41.0							16	13	3.4	1.7
42.0							20	15	3.4	3.4
43.0							22	17	3.4	3.4
44.0							23	18	1.7	1.7
45.0							25	20	3.4	3.4
46.1							27	22	3.4	3.4
47.1							29	24	3.4	3.4
48.1							31	26	3.4	3.4
49.1							33	28	3.4	3.4
50.2							35	29	3.4	1.7
51.2							37	31	3.4	3.4
52.2							39	33	3.4	3.4
53.2							41	35	3.4	3.4
54.3							43	37	3.4	3.4
55.3							45	39	3.4	3.4
56.3							47	41	3.4	3.4
57.3							49	43	3.4	3.4
58.4							50	45	1.7	3.4
59.4							52	46	3.4	1.7
60.4							54	48	3.4	3.4
61.4							56	50	3.4	3.4

TIME SEC.	R+ CNTS	R- CNTS	TOTAL R CNTS	B+ CNTS	B- CNTS	TOTAL B CNTS	ORF CNTS	OLR CNTS	SPEED-RF KM/HR.	SPEED-LI KM/HR.
62.4							59	52	5.1	3.4
63.5							61	55	3.4	5.1
64.5							63	57	3.4	3.4
65.5							66	59	5.1	3.4
66.5							68	61	3.4	3.4
67.6							70	63	3.4	3.4
68.6							72	66	3.4	5.1
69.6							75	68	5.1	3.4
70.6							78	71	5.1	5.1
71.7							80	74	3.4	5.1
72.7							83	76	5.1	3.4
73.7	1		1	6		6	86	79	5.1	5.1
74.7	1		1	16		16	89	82	5.1	5.1
75.8	1	1		16		16	92	85	5.1	5.1
76.8	1	1		16		16	95	88	5.1	5.1
77.8	2	1	1	25		25	98	91	5.1	5.1
78.8	2	1	1	34		34	101	94	5.1	5.1
79.9	2	1	1	43		43	104	97	5.1	5.1
80.9	2	1	1	52		52	107	101	5.1	6.8
81.9	2	1	1	62		62	110	104	5.1	5.1
82.9	2	1	1	71		71	114	108	6.8	6.8
83.9	2	1	1	80		80	119	113	8.6	8.6
85.0	2	1	1	90		90	124	118	8.6	8.6
86.0	2	1	1	91	1	90	129	123	8.6	8.6
87.0	2	1	1	93	3	90	134	128	8.6	8.6
88.0	2	1	1	95	3	92	139	133	8.6	8.6
89.1	2	1	1	97	3	94	144	138	8.6	8.6
90.1	2	1	1	97	3	94	150	144	10.3	10.3
91.2	2	1	1	97	3	94	155	149	8.6	8.6
92.1	2	1	1	97	6	91	161	155	10.3	10.3
93.2	2	1	1	100	7	93	166	160	8.6	8.6
94.2	2	1	1	103	9	94	172	165	10.3	8.6
95.2	2	1	1	103	9	94	177	170	8.6	8.6
96.2	2	1	1	103	9	94	182	175	8.6	8.6
97.3	2	1	1	103	9	94	187	180	8.6	8.6
98.3	2	1	1	103	9	94	192	184	8.6	6.8
99.3	2	1	1	103	9	94	198	190	10.3	10.3
100.3	2	1	1	103	9	94	203	195	8.6	8.6
101.4	2	1	1	103	9	94	209	201	10.3	10.3
102.4	2	1	1	103	9	94	214	206	8.6	8.6
103.3	2	1	1	103	12	91	219	212	8.6	10.3
104.4	2	1	1	103	12	91	224	217	8.6	8.6
105.4	2	1	1	103	12	91	229	222	8.6	8.6
106.5	2	1	1	103	12	91	234	227	8.6	8.6
107.5	2	1	1	103	12	91	239	232	8.6	8.6
108.5	2	1	1	103	12	91	245	238	10.3	10.3
109.5	2	1	1	104	12	92	250	243	8.6	8.6
110.6	2	1	1	104	13	91	255	248	8.6	8.6
111.6	2	1	1	106	13	93	260	254	8.6	10.3
112.6	2	1	1	106	14	92	266	259	10.3	8.6
113.6	2	1	1	106	14	92	272	265	10.3	10.3
114.7	2	1	1	107	14	93	277	270	8.6	8.6
115.7	2	1	1	107	15	92	283	276	10.3	10.3
116.7	2	1	1	107	15	92	289	281	10.3	8.6
117.7	2	1	1	107	16	91	296	287	12.0	10.3
118.8	2	1	1	107	16	91	301	293	8.6	10.3
119.8	3	1	2	107	16	91	308	299	12.0	10.3
120.8	3	2	1	107	16	91	313	304	8.6	8.6
121.8	4	2	2	107	18	89	319	309	10.3	8.6
122.9	4	2	2	108	18	90	325	315	10.3	10.3

TIME SEC.	R+ CNTS	R- CNTS	TOTAL R CNTS	B+ CNTS	B- CNTS	TOTAL B CNTS	ORF CNTS	OLR CNTS	SPEED-RF KM/HR.	SPEED-LI KM/HR.
123.9	4	2	2	109	20	89	330	320	8.6	8.6
124.9	4	2	2	109	20	89	336	326	10.3	10.3
125.9	4	2	2	109	20	89	342	332	10.3	10.3
126.9	4	2	2	110	21	89	348	338	10.3	10.3
128.0	4	2	2	110	22	88	353	344	8.6	10.3
129.0	4	2	2	110	24	86	359	350	10.3	10.3
130.0	4	2	2	111	24	87	365	356	10.3	10.3
131.0	4	2	2	111	25	86	371	362	10.3	10.3
132.1	4	2	2	111	25	86	377	368	10.3	10.3
133.1	4	2	2	111	26	85	383	374	10.3	10.3
134.1	4	2	2	112	26	86	389	380	10.3	10.3
135.1	4	2	2	112	27	85	395	386	10.3	10.3
136.2	4	2	2	112	27	85	401	392	10.3	10.3
137.2	4	2	2	112	27	85	407	399	10.3	12.0
138.2	4	2	2	113	28	85	413	405	10.3	10.3
139.2	4	2	2	113	28	85	419	411	10.3	10.3
140.3	4	2	2	113	28	85	423	416	6.8	8.6
141.3	4	2	2	114	29	85	429	421	10.3	8.6
142.3	4	2	2	114	30	84	434	426	8.6	8.6
143.3	4	2	2	114	30	84	439	431	8.6	8.6
144.3	4	2	2	114	31	83	444	436	8.6	8.6
145.4	4	2	2	115	31	84	450	441	10.2	8.6
146.4	4	2	2	115	32	83	456	447	10.3	10.3
147.4	4	2	2	115	32	83	463	452	12.0	8.6
148.4	4	2	2	115	33	82	469	458	10.3	10.3
149.5	4	2	2	116	33	83	475	464	10.3	10.3
150.5	4	2	2	116	34	82	481	470	10.3	10.3
151.5	4	2	2	116	35	81	487	476	10.3	10.3
152.5	4	2	2	116	35	81	493	482	10.3	10.3
153.6	4	2	2	116	36	80	500	489	12.0	12.0
154.6	4	2	2	116	36	80	505	495	8.6	10.3
155.6	4	2	2	116	37	79	511	501	10.3	10.3
156.6	4	2	2	116	37	79	516	507	8.6	10.3
157.7	4	2	2	116	37	79	522	513	10.3	10.3
158.7	4	2	2	116	37	79	527	518	8.6	8.6
159.7	5	2	3	116	37	79	533	524	10.3	10.3
160.7	5	2	3	116	37	79	538	529	8.6	8.6
161.8	5	2	3	116	37	79	545	535	12.0	10.3
162.8	5	2	3	116	38	78	551	540	10.3	8.6
163.8	5	2	3	116	38	78	557	546	10.3	10.3
164.8	5	2	3	117	39	78	563	552	10.3	10.3
165.8	5	2	3	117	39	78	569	559	10.3	12.0
166.9	5	2	3	117	39	78	576	565	12.0	10.3
167.9	5	2	3	117	40	77	583	572	12.0	12.0
168.9	5	2	3	117	41	76	589	578	10.3	10.3
169.9	5	2	3	118	42	76	596	584	12.0	10.3
171.0	5	2	3	118	42	76	602	590	10.3	10.3
172.0	5	2	3	118	42	76	608	596	10.3	10.3
173.0	5	2	3	119	43	76	615	602	12.0	10.3
174.0	5	2	3	119	44	75	621	609	10.3	12.0
175.1	5	2	3	119	44	75	627	615	10.3	10.3
176.1	5	2	3	119	44	75	633	621	10.3	10.3
177.1	5	2	3	119	44	75	639	628	10.3	12.0
178.1	5	2	3	119	45	74	646	634	12.0	10.3
179.2	5	2	3	119	45	74	652	640	10.3	10.3
180.2	5	2	3	120	46	74	660	648	13.7	13.7
181.2	5	2	3	120	47	73	667	656	12.0	13.7
182.2	5	2	3	120	47	73	671	661	6.8	8.6
183.3	5	2	3	121	48	73	681	671	17.2	17.2
184.3	5	2	3	121	48	73	684	675	5.1	6.8

REPRODUCIBILITY OF THE
ORIGINAL PAGE IS POOR

TIME SEC.	R+ CNTS	R- CNTS	TOTAL R CNTS	B+ CNTS	B- CNTS	TOTAL B CNTS	ORF CNTS	OLR CNTS	SPEED-RF KM/HR.	SPEED-L KM/HR.
185.3	5	2	3	123	48	75	669	660	8.6	8.6
186.3	5	2	3	123	48	75	693	684	6.8	6.8
187.3	5	2	3	123	49	74	698	689	8.6	8.6
188.4	5	2	3	124	49	75	704	695	10.3	10.3
189.4	5	2	3	124	49	75	708	700	6.8	8.6
190.4	5	2	3	124	49	75	713	705	8.6	8.6
191.4	5	2	3	125	49	76	719	710	10.3	8.6
19 5	5	2	3	125	49	76	724	716	8.6	10.3
193.	5	2	3	125	49	76	730	722	10.3	10.3
194.5	5	2	3	125	49	76	735	727	8.6	8.6
195.5	5	2	3	126	49	77	741	733	10.3	10.3
196.6	5	2	3	126	49	77	747	738	10.3	8.6
197.6	5	2	3	127	49	78	752	744	8.6	10.3
198.6	5	2	3	127	49	78	757	749	8.6	8.6
199.6	5	2	3	127	49	78	763	753	10.3	8.8
200.7	5	2	3	128	49	79	773	762	17.2	10.3
201.7	6	2	4	128	49	79	777	766	6.8	8.6
202.7	6	2	4	128	49	79	781	769	6.8	5.1
203.7	6	2	4	128	49	79	785	773	6.8	6.8
204.8	6	2	4	128	49	79	789	777	6.8	6.8
205.8	6	2	4	128	49	79	794	781	8.6	6.8
206.8	6	2	4	128	49	79	798	785	6.8	6.8
207.8	6	2	4	128	49	79	803	790	8.6	8.6
208.8	6	2	4	128	50	78	807	794	6.8	6.8
209.9	6	2	4	128	50	78	812	799	8.6	8.6
210.9	6	2	4	128	50	78	816	804	6.8	8.6
211.9	6	2	4	128	50	78	820	809	6.8	8.6
212.9	6	2	4	128	50	78	825	813	8.6	6.8
214.0	6	2	4	128	50	78	829	818	6.8	8.6
215.0	6	2	4	128	50	78	834	823	8.6	8.6
216.0	6	2	4	128	50	78	839	828	8.6	8.6
217.0	6	2	4	128	50	78	844	833	8.6	8.6
218.1	6	2	4	128	50	78	850	838	10.3	8.6
219.1	6	2	4	128	50	78	855	843	8.6	8.6
220.1	6	2	4	128	50	78	859	848	6.8	8.6
221.1	6	2	4	128	50	78	865	854	10.3	10.3
222.2	6	2	4	128	50	78	868	859	5.1	8.6
223.2	6	2	4	128	50	78	872	863	6.8	6.8
224.2	6	2	4	128	50	78	876	866	6.8	5.1
225.2	6	2	4	128	50	78	879	871	5.1	8.6
226.2	6	2	4	129	50	79	884	875	6.8	6.8
227.3	6	2	4	129	50	79	888	880	6.8	8.6
228.3	6	2	4	129	50	79	893	885	8.6	8.6
229.3	6	2	4	129	50	79	898	890	8.6	8.6
230.3	6	2	4	129	50	79	904	895	10.3	8.6
231.4	6	2	4	130	50	80	909	901	8.6	10.3
232.4	6	2	4	130	50	80	915	907	10.3	10.3
233.4	6	2	4	130	50	80	923	915	13.7	13.7
234.4	6	2	4	131	50	81	926	920	5.1	8.6
235.5	6	2	4	131	50	81	930	924	6.8	6.8
236.5	6	2	4	131	50	81	934	928	6.8	6.8
237.5	6	2	4	131	50	81	939	932	8.6	6.8
238.5	6	2	4	131	50	81	944	936	8.6	6.8
239.6	6	2	4	132	50	82	948	940	6.8	6.8
240.6	6	2	4	132	50	82	953	945	8.6	8.6
241.6	6	2	4	133	50	83	959	949	10.3	6.8
242.6	6	2	4	133	50	83	963	953	6.8	6.8
243.7	6	2	4	133	50	83	968	958	8.6	8.6
244.7	6	2	4	133	50	83	972	962	6.8	6.8
245.7	6	2	4	133	50	83	977	966	8.6	6.8

TIME SEC.	R+ CNTS	R- CNTS	TOTAL R CNTS	B+ CNTS	B- CNTS	TOTAL B CNTS	ORF CNTS	OLR CNTS	SPEED-RF KM/HR.	SPEED-LI KM/HR.
246.7	6	2	4	133	50	83	982	970	6.6	6.8
247.7	6	2	4	133	50	83	989	976	12.0	10.3
248.8	6	2	4	133	50	83	994	981	8.6	8.6
249.8	6	2	4	134	50	84	999	986	8.6	8.6
250.8	6	2	4	134	50	84	1003	991	6.8	8.6
251.8	6	2	4	134	51	83	1008	995	8.6	6.8
252.9	6	2	4	134	51	83	1012	1000	6.8	8.6
253.9	6	2	4	134	51	83	1017	1004	8.6	6.8
254.9	6	2	4	134	51	83	1022	1009	8.6	8.6
255.9	6	2	4	135	51	84	1026	1014	6.8	8.6
257.0	7	2	5	135	52	83	1031	1020	8.6	10.3
258.0	7	2	5	135	52	83	1037	1026	10.3	10.3
259.0	7	2	5	136	53	83	1043	1032	10.3	10.3
260.0	7	2	5	136	53	83	1048	1038	8.6	10.3
261.1	7	2	5	136	53	83	1054	1043	10.3	8.6
262.1	7	2	5	136	53	83	1060	1049	10.3	10.3
263.1	7	2	5	136	53	83	1065	1054	8.6	8.6
264.1	7	2	5	137	53	84	1071	1059	10.3	8.6
265.2	7	2	5	137	54	83	1076	1065	8.6	10.3
266.2	7	2	5	137	54	83	1082	1071	10.3	10.3
267.2	7	2	5	137	54	83	1088	1077	10.3	10.3
268.2	7	2	5	137	54	83	1094	1083	10.3	10.3
269.2	7	2	5	138	54	84	1100	1089	10.3	10.3
270.3	7	2	5	138	55	83	1106	1095	10.3	10.3
271.3	7	2	5	139	56	83	1112	1100	10.3	8.6
272.3	7	2	5	139	56	83	1117	1106	8.6	10.3
273.3	7	2	5	140	57	83	1123	1111	10.3	8.6
274.4	7	2	5	140	57	83	1129	1117	10.3	10.3
275.4	7	2	5	140	57	83	1134	1122	8.6	8.6
276.4	7	2	5	141	57	84	1139	1127	8.6	8.6
277.4	7	2	5	141	58	83	1144	1131	8.6	6.8
278.5	7	2	5	141	58	83	1148	1135	6.8	6.8
279.5	7	2	5	141	58	83	1151	1139	5.1	6.8
280.5	7	2	5	141	58	83	1155	1142	6.8	5.1
281.5	7	2	5	141	58	83	1158	1145	5.1	5.1
282.6	7	2	5	141	58	83	1158	1145	.0	.0
283.6	7	2	5	141	58	83	1159	1145	1.7	.0
284.6	7	2	5	141	58	83	1159	1145	.0	.0
285.6	7	2	5	141	58	83	1160	1145	1.7	.0
286.7	7	2	5	141	58	83	1161	1146	1.7	1.7
287.7	7	2	5	141	58	83	1162	1148	1.7	3.4
288.7	7	2	5	141	59	82	1164	1150	3.4	3.4
289.7	7	2	5	141	59	82	1166	1152	3.4	3.4
290.7	7	2	5	141	59	82	1168	1154	3.4	3.4
291.8	7	2	5	141	59	82	1170	1156	3.4	3.4
292.8	7	2	5	141	59	82	1172	1159	3.4	5.1
293.8	7	2	5	141	59	82	1174	1161	3.4	3.4
294.8	7	2	5	141	59	82	1176	1163	3.4	3.4
295.9	7	2	5	141	59	82	1178	1165	3.4	3.4
296.9	7	2	5	141	59	82	1179	1167	1.7	3.4
297.9	7	2	5	141	59	82	1179	1167	.0	.0
298.9	7	2	5	141	59	82	1179	1167	.0	.0
300.0	7	2	5	141	59	82	1179	1167	.0	.0
301.0	7	2	5	141	59	82	1179	1167	.0	.0
302.0	7	2	5	142	59	83	1180	1167	1.7	.0
303.0	7	2	5	142	59	83	1182	1169	3.4	3.4
304.1	7	2	5	142	59	83	1183	1170	1.7	1.7
305.1	7	2	5	142	59	83	1184	1172	1.7	3.4
306.1	7	2	5	142	59	83	1186	1174	3.4	3.4
307.1	7	2	5	142	59	83	1186	1174	.0	.0

TIME SEC.	R+ CNTS	R- CNTS	TOTAL R CNTS	B+ CNTS	B- CNTS	TOTAL B CNTS	ORF CNTS	OLR CNTS	SPEED-RF KM/HR.	SPEED-LI KM/HR.
308.1	7	2	5	142	59	83	1187	1175	1.7	1.7
309.2	7	2	5	142	59	83	1188	1176	1.7	1.7
310.2	7	2	5	142	59	83	1188	1177	.0	1.7
311.2	7	2	5	142	59	83	1189	1177	1.7	.0
312.2	7	2	5	142	59	83	1189	1177	.0	.0
313.3	7	2	5	142	59	83	1189	1177	.0	.0
314.3	7	2	5	142	59	83	1189	1177	.0	.0
315.3	7	2	5	142	59	83	1189	1177	.0	.0
316.3	7	2	5	142	59	83	1189	1177	.0	.0
317.4	7	2	5	142	59	83	1189	1177	.0	.0
318.4	7	2	5	142	59	83	1189	1177	.0	.0
319.4	7	2	5	142	59	83	1189	1177	.0	.0
320.4	7	2	5	142	59	83	1189	1177	.0	.0
321.5	7	2	5	142	59	83	1189	1177	.0	.0
322.5	7	2	5	142	59	83	1189	1177	.0	.0
323.5	7	2	5	142	59	83	1189	1177	.0	.0
324.5	7	2	5	142	59	83	1189	1177	.0	.0
325.6	7	2	5	142	59	83	1189	1177	.0	.0
326.6	7	2	5	142	59	83	1189	1177	.0	.0
327.6	7	2	5	142	59	83	1189	1177	.0	.0
328.6	7	2	5	142	59	83	1189	1177	.0	.0
329.6	7	2	5	142	59	83	1189	1177	.0	.0
330.7	7	2	5	142	59	83	1189	1177	.0	.0
331.7	7	2	5	142	59	83	1189	1177	.0	.0
332.7	7	2	5	142	59	83	1189	1177	.0	.0
333.7	7	2	5	142	59	83	1189	1177	.0	.0
334.8	7	2	5	142	59	83	1189	1177	.0	.0
335.8	7	2	5	142	59	83	1189	1177	.0	.0
336.8	7	2	5	142	59	83	1189	1177	.0	.0
337.8	7	2	5	142	59	83	1189	1177	.0	.0
338.9	7	2	5	142	59	83	1189	1177	.0	.0
339.9	7	2	5	142	59	83	1189	1177	.0	.0
340.9	7	2	5	142	59	83	1189	1177	.0	.0
341.9	7	2	5	142	59	83	1189	1177	.0	.0
343.0	7	2	5	142	59	83	1189	1177	.0	.0
344.0	7	2	5	142	59	83	1189	1177	.0	.0
345.0	7	2	5	142	59	83	1189	1177	.0	.0
346.0	7	2	5	142	59	83	1189	1177	.0	.0
347.1	7	2	5	142	59	83	1189	1177	.0	.0
348.1	7	2	5	142	59	83	1189	1177	.0	.0
349.1	7	2	5	142	59	83	1189	1177	.0	.0
350.1	7	2	5	142	59	83	1189	1177	.0	.0
351.1	7	2	5	142	59	83	1189	1177	.0	.0
352.2	7	2	5	142	59	83	1189	1177	.0	.0
353.2	7	2	5	142	59	83	1189	1177	.0	.0
354.2	7	2	5	142	59	83	1189	1177	.0	.0
355.2	7	2	5	142	59	83	1189	1177	.0	.0
356.3	7	2	5	142	59	83	1189	1177	.0	.0
357.3	7	2	5	142	59	83	1189	1177	.0	.0
358.3	7	2	5	142	59	83	1189	1177	.0	.0
359.3	7	2	5	142	59	83	1189	1177	.0	.0
360.4	7	2	5	142	59	83	1189	1177	.0	.0
361.4	7	2	5	142	59	83	1189	1177	.0	.0
362.4	7	2	5	142	59	83	1189	1177	.0	.0
363.4	7	2	5	142	59	83	1189	1177	.0	.0
364.5	7	2	5	142	59	83	1189	1177	.0	.0
365.5	7	2	5	142	59	83	1189	1177	.0	.0
366.5	7	2	5	142	59	83	1189	1177	.0	.0
367.5	7	2	5	142	59	83	1189	1177	.0	.0
368.6	7	2	5	142	59	83	1189	1177	.0	.0

TIME SEC.	R+ CNTS	R- CNTS	TOTAL R CNTS	B+ CNTS	B- CNTS	TOTAL B CNTS	ORF CNTS	OLR CNTS	SPEED-RF KM/HR.		SPEED-LF KM/HR.
369.6	7	2	5	142	59	83	1188	1177	.0		0
370.6	7	2	5	142	59	83	1189	1177	.0		
371.6	7	2	5	142	59	83	1189	1177	.0		
372.6	7	2	5	142	59	83	1189	1177	.0		.0
373.7	7	2	5	142	59	83	1189	1177	.0		.0
374.7	7	2	5	142	59	83	1189	1177	.0		.0
375.7	7	2	5	142	59	83	1189	1177	.0		.0
376.7	7	2	5	142	59	83	1189	1177	.0		.0
377.8	7	2	5	142	59	83	1189	1177	.0		.0
378.8	7	2	5	142	59	83	1189	1177	.0		.0
379.8	7	2	5	142	59	83	1189	1178	.0		1.7
380.8	7	2	5	142	59	83	1189	1178	.0		.0
381.9	7	2	5	142	59	83	1189	1178	.0		.0
382.9	7	2	5	142	59	83	1190	1179	1.7		1.7
383.9	7	2	5	142	59	83	1190	1180	.0		1.7
384.9	7	2	5	142	59	83	1191	1181	1.7		1.7
386.0	7	2	5	142	59	83	1192	1182	1.7		1.7
387.0	7	2	5	142	59	83	1192	1183	.0		1.7
388.0	7	2	5	142	59	83	1193	1184	1.7		1.7
389.0	7	2	5	142	59	83	1194	1186	1.7		3.4
390.0	7	2	5	143	59	84	1195	1187	1.7		1.7
391.1	7	2	5	143	59	84	1196	1189	1.7		3.4
392.1	7	2	5	143	59	84	1196	1190	.0		1.7
393.1	7	2	5	143	59	84	1197	1192	1.7	EP-4	3.4
394.1	7	2	5	143	59	84	1198	1194	1.7		3.4
395.2	7	2	5	143	59	84	1199	1196	1.7		3.4
396.2	7	2	5	143	59	84	1201	1197	3.4		1.7
397.2	7	2	5	143	60	83	1201	1199	.0		3.4
398.2	7	2	5	143	60	83	1203	1201	3.4		3.4
399.3	7	2	5	143	60	83	1204	1203	1.7		3.4
400.3	7	2	5	143	60	83	1205	1204	1.7		1.7
401.3	7	2	5	143	60	83	1206	1206	1.7		3.4
402.3	7	2	5	143	60	83	1206	1208	.0		3.4
403.4	7	2	5	143	60	83	1207	1209	1.7		1.7
404.4	7	2	5	143	60	83	1208	1211	1.7		3.4
405.4	7	2	5	143	60	83	1210	1213	3.4		3.4
406.4	7	2	5	143	60	83	1211	1214	1.7		1.7
407.5	7	2	5	143	60	83	1211	1214	.0		.0
408.5	7	2	5	143	60	83	1211	1214	.0		.0
409.5	7	2	5	143	60	83	1211	1214	.0		.0
410.5	7	2	5	143	60	83	1211	1214	.0		.0
411.5	7	2	5	143	60	83	1211	1214	.0		.0
412.6	7	2	5	143	60	83	1211	1214	.0		.0
413.6	7	2	5	143	60	83	1211	1214	.0		.0
414.6	7	2	5	143	60	83	1211	1214	.0		.0
415.6	7	2	5	143	60	83	1211	1214	.0		.0
416.7	7	2	5	143	60	83	1211	1214	.0		.0
417.7	7	2	5	143	60	83	1211	1214	.0		.0
418.7	7	2	5	143	60	83	1211	1214	.0		.0
419.7	7	2	5	143	60	83	1211	1214	.0		.0
420.8	7	2	5	143	60	83	1211	1214	.0		.0
421.8	7	2	5	143	60	83	1211	1214	.0		.0
422.8	7	2	5	143	60	83	1211	1214	.0		.0
423.8	7	2	5	143	60	83	1211	1214	.0		.0
424.9	7	2	5	143	60	83	1211	1214	.0		.0
425.9	7	2	5	143	60	83	1211	1214	.0		.0
426.9	7	2	5	143	60	83	1211	1214	.0		.0
427.9	7	2	5	143	60	83	1211	1214	.0		.0
429.0	7	2	5	143	60	83	1211	1214	.0		.0
430.0	7	2	5	143	60	83	1211	1214	.0		.0

TIME SEC.	R+ CNTS	R- CNTS	TOTAL R CNTS	B+ CNTS	B- CNTS	TOTAL B CNTS	ORF CNTS	OLR CNTS	SPEED-RF KM/HR.	SPEED-LI KM/HR.
431.0	7	2	5	143	60	83	1211	1214	.0	.0
432.0	7	2	5	143	60	83	1211	1214	.0	.0
433.0	7	2	5	143	60	83	1211	1214	.0	.0
434.1	7	2	5	143	60	83	1211	1214	.0	.0
435.1	7	2	5	143	60	83	1211	1214	.0	.0
436.1	7	2	5	143	60	83	1211	1214	.0	.0
437.1	7	2	5	143	60	83	1211	1214	.0	.0
438.2	7	2	5	143	60	83	1211	1214	.0	.0
439.2	7	2	5	143	60	83	1211	1214	.0	.0
440.2	7	2	5	143	60	83	1211	1214	.0	.0
441.2	7	2	5	143	60	83	1211	1214	.0	.0
442.3	7	2	5	143	60	83	1211	1214	.0	.0
443.3	7	2	5	143	60	83	1211	1214	.0	.0
444.3	7	2	5	143	60	83	1211	1214	.0	.0
445.3	7	2	5	143	60	83	1211	1214	.0	.0
446.4	7	2	5	143	60	83	1211	1214	.0	.0
447.4	7	2	5	143	60	83	1211	1214	.0	.0
448.4	7	2	5	143	60	83	1211	1214	.0	.0
449.4	7	2	5	143	60	83	1211	1214	.0	.0
450.5	7	2	5	143	60	83	1211	1214	.0	.0
451.5	7	2	5	143	60	83	1211	1214	.0	.0
452.5	7	2	5	143	60	83	1211	1214	.0	.0
453.5	7	2	5	143	60	83	1211	1214	.0	.0
454.5	7	2	5	143	60	83	1211	1214	.0	.0
455.6	7	2	5	143	60	83	1211	1214	.0	.0
456.6	7	2	5	143	60	83	1211	1214	.0	.0
457.6	7	2	5	143	60	83	1211	1214	.0	.0
458.6	7	2	5	143	60	83	1211	1214	.0	.0
459.7	7	2	5	143	60	83	1211	1214	.0	.0
460.7	7	2	5	143	60	83	1211	1214	.0	.0
461.7	7	2	5	143	60	83	1211	1214	.0	.0
462.7	7	2	5	143	60	83	1211	1214	.0	.0
463.8	7	2	5	143	60	83	1211	1214	.0	.0
464.8	7	2	5	143	60	83	1211	1214	.0	.0
465.8	7	2	5	143	60	83	1211	1214	.0	.0
466.8	7	2	5	143	60	83	1211	1214	.0	.0
467.9	7	2	5	143	60	83	1211	1214	.0	.0
468.9	7	2	5	143	60	83	1211	1214	.0	.0
469.9	7	2	5	143	60	83	1211	1214	.0	.0
470.9	7	2	5	143	60	83	1211	1214	.0	.0
471.9	7	2	5	143	60	83	1211	1214	.0	.0
473.0	7	2	5	143	60	83	1211	1214	.0	.0
474.0	7	2	5	143	60	83	1211	1214	.0	.0
475.0	7	2	5	143	60	83	1211	1214	.0	.0
476.0	7	2	5	143	60	83	1211	1214	.0	.0
477.1	7	2	5	143	60	83	1211	1214	.0	.0
478.1	7	2	5	143	60	83	1211	1214	.0	.0
479.1	7	2	5	143	60	83	1211	1214	.0	.0
480.1	7	2	5	143	60	83	1211	1214	.0	.0
481.2	7	2	5	143	60	83	1211	1214	.0	.0
482.2	7	2	5	143	60	83	1211	1214	.0	.0
483.2	7	2	5	143	60	83	1211	1214	.0	.0
484.2	7	2	5	143	60	83	1211	1214	.0	.0
485.3	7	2	5	143	60	83	1211	1214	.0	.0
486.3	7	2	5	143	60	83	1211	1214	.0	.0
487.3	7	2	5	143	60	83	1211	1214	.0	.0
488.3	7	2	5	143	60	83	1211	1214	.0	.0
489.4	7	2	5	143	60	83	1211	1214	.0	.0
490.4	7	2	5	143	60	83	1211	1214	.0	.0
491.4	7	2	5	143	60	83	1211	1214	.0	.0

TIME SEC.	R+ CNTS	R- CNTS	TOTAL R CNTS	B+ CNTS	B- CNTS	TOTAL B CNTS	ORF CNTS	OLR CNTS	SPEED-RF KM/HR.	SPEED-. KM/HR.
492.4	7	2	5	143	60	83	1211	1214	.0	.0
493.4	7	2	5	143	60	83	1211	1214	.0	.0
494.5	7	2	5	143	60	83	1211	1214	.0	.0
495.5	7	2	5	143	60	83	1211	1214	.0	.0
496.5	7	2	5	143	60	83	1211	1214	.0	.0
497.5	7	2	5	143	60	83	1211	1214	.0	.0
498.6	7	2	5	143	60	83	1211	1214	.0	.0
499.6	7	2	5	143	60	83	1211	1214	.0	.0
500.6	7	2	5	143	60	83	1211	1214	.0	.0
501.6	7	2	5	143	60	83	1211	1214	.0	.0
502.7	7	2	5	143	60	83	1211	1214	.0	.0
503.7	7	2	5	143	60	83	1211	1214	.0	.0
504.7	7	2	5	143	60	83	1211	1214	.0	.0
505.7	7	2	5	143	60	83	1211	1214	.0	.0
506.8	7	2	5	143	60	83	1211	1214	.0	.0
507.8	7	2	5	143	60	83	1211	1214	.0	.0
508.8	7	2	5	143	60	83	1211	1214	.0	.0
509.8	7	2	5	143	60	83	1211	1214	.0	.0
510.9	7	2	5	143	60	83	1211	1214	.0	.0
511.9	7	2	5	143	60	83	1211	1214	.0	.0
512.9	7	2	5	143	60	83	1211	1214	.0	.0
513.9	7	2	5	143	60	83	1211	1214	.0	.0
514.9	7	2	5	143	60	83	1211	1214	.0	.0
516.0	7	2	5	143	60	83	1211	1214	.0	.0
517.0	7	2	5	143	60	83	1211	1214	.0	.0
518.0	7	2	5	143	60	83	1211	1214	.0	.0
519.0	7	2	5	143	60	83	1211	1214	.0	.0
520.1	7	2	5	143	60	83	1211	1214	.0	.0
521.1	7	2	5	143	60	83	1213	1216	3.4	3.4
522.1	7	2	5	143	60	83	1215	1217	3.4	1.7
523.1	7	2	5	144	61	83	1221	1223	10.3	10.3
524.2	7	2	5	144	62	82	1224	1227	5.1	6.8
525.2	7	2	5	144	62	82	1227	1231	5.1	6.8
526.2	7	2	5	144	62	82	1229	1233	3.4	3.4
527.2	7	2	5	144	62	82	1230	1236	1.7	5.1
528.3	7	2	5	144	62	82	1233	1238	5.1	3.4
529.3	7	2	5	144	63	81	1236	1243	5.1	8.6
530.3	7	2	5	145	63	82	1242	1249	10.3	10.3
531.3	7	2	5	145	63	82	1244	1252	3.4	5.1
532.4	7	2	5	145	63	82	1247	1255	5.1	5.1
533.4	7	2	5	145	63	82	1253	1260	10.3	8.6
534.4	7	2	5	145	63	82	1257	1265	6.8	8.6
535.4	7	2	5	145	63	82	1261	1269	6.8	6.8
536.4	7	2	5	146	64	82	1266	1274	8.6	8.6
37.5	7	2	5	146	64	82	1271	1279	8.6	8.6
538.5	7	2	5	146	64	82	1277	1285	10.3	10.3
539.5	7	2	5	146	64	82	1282	1290	8.6	8.6
540.5	7	2	5	147	64	83	1291	1297	15.5	12.0
541.6	7	2	5	147	65	82	1296	1302	8.6	8.6
542.6	8	2	6	147	65	82	1300	1306	6.8	6.8
543.6	8	2	6	148	65	83	1304	1309	6.8	5.1
544.6	8	2	6	148	65	83	1308	1313	6.8	6.8
545.7	8	2	6	149	65	84	1312	1317	6.8	6.8
546.7	8	2	6	149	67	82	1316	1321	6.8	6.8
547.7	8	2	6	149	67	82	1321	1325	8.6	6.8
548.7	8	2	6	150	67	83	1326	1330	6.6	8.6
549.8	8	2	6	150	67	83	1331	1334	8.6	6.8
550.8	8	2	6	151	67	84	1336	1339	8.6	8.6
551.8	8	2	6	151	68	83	1342	1345	10.3	10.3
552.8	8	2	6	151	68	83	1348	1351	10.3	10.3

TIME SEC.	R+ CNTS	R- CNTS	TOTAL R CNTS	B+ CNTS	B- CNTS	TOTAL B CNTS	ORT CNTS	OLR CNTS	SPEED-RF KM/HR.	SPEED-L KM/HR.
553.8	8	2	6	151	68	83	1353	1357	8.6	10.3
554.9	8	2	6	151	68	83	1359	1362	10.3	8.6
555.9	8	2	6	152	68	84	1364	1368	8.6	10.3
556.9	8	2	6	152	69	83	1371	1374	12.0	10.3
557.9	8	2	6	152	69	83	1377	1380	10.3	10.3
559.0	8	2	6	153	69	84	1383	1386	10.3	10.3
560.0	8	2	6	153	70	83	1389	1392	10.3	10.3
561.0	8	2	6	154	70	84	1396	1398	12.0	10.3
562.0	8	2	6	154	71	83	1401	1404	8.6	10.3
563.1	8	2	6	155	71	84	1409	1411	13.7	12.0
564.1	8	2	6	155	73	82	1414	1416	8.6	8.6
565.1	8	2	6	156	73	83	1419	1421	8.6	8.6
566.1	8	2	6	156	73	83	1424	1426	8.6	8.6
567.2	8	2	6	156	73	83	1430	1430	10.3	8.6
568.2	8	2	6	157	74	83	1436	1436	10.3	10.3
569.2	8	2	6	157	75	82	1441	1441	8.6	8.6
570.2	8	2	6	157	75	82	1445	1447	6.8	10.3
571.3	8	2	6	157	75	82	1450	1451	8.6	6.8
572.3	8	2	6	157	75	82	1455	1457	8.6	10.3
573.3	8	2	6	157	75	82	1459	1462	6.8	8.6
574.3	8	2	6	157	75	82	1465	1467	10.3	8.6
575.3	8	2	6	157	75	82	1470	1473	8.6	10.3
576.4	8	2	6	157	75	82	1476	1479	10.3	10.3
577.4	8	2	6	157	75	82	1481	1485	8.6	10.3
578.4	8	2	6	157	75	82	1487	1491	10.3	10.3
579.4	8	2	6	157	75	82	1492	1497	8.6	10.3
580.5	8	2	6	157	75	82	1498	1502	10.3	8.6
581.5	8	2	6	157	75	82	1503	1507	8.6	8.6
582.5	8	2	6	157	75	82	1508	1513	8.6	10.3
583.5	8	2	6	157	75	82	1514	1518	10.3	8.6
584.6	9	2	7	157	75	82	1519	1524	8.6	10.3
585.6	9	2	7	157	75	82	1525	1530	10.3	10.3
586.6	9	2	7	157	75	82	1531	1536	10.3	10.3
587.6	9	2	7	157	75	82	1537	1542	10.3	10.3
588.7	9	2	7	157	75	82	1543	1549	10.3	12.0
589.7	9	2	7	157	75	82	1549	1555	10.3	10.3
590.7	9	2	7	157	75	82	1555	1561	10.3	10.3
591.7	9	2	7	157	75	82	1561	1567	10.3	10.3
592.8	9	2	7	157	75	82	1567	1574	10.3	12.0
593.8	9	2	7	158	75	83	1573	1580	10.3	10.3
594.8	9	2	7	158	75	83	1579	1586	10.3	10.3
595.8	9	2	7	158	75	83	1585	1592	10.3	10.3
596.8	9	2	7	158	76	82	1591	1597	10.3	8.6
597.9	9	2	7	159	76	83	1597	1602	10.3	8.6
598.9	9	2	7	159	76	83	1607	1612	17.2	17.2
599.9	9	2	7	159	76	83	1613	1618	10.3	10.3
600.9	9	2	7	159	76	83	1619	1624	10.3	10.3
602.0	9	2	7	159	76	83	1622	1629	5.1	8.6
603.0	9	2	7	159	76	83	1626	1633	6.8	6.8
604.0	9	2	7	159	76	83	1631	1638	8.6	8.6
605.0	9	2	7	159	76	83	1636	1643	8.6	8.6
606.1	9	2	7	159	76	83	1641	1649	8.6	10.3
607.1	9	2	7	159	76	83	1647	1655	10.3	10.3
608.1	9	2	7	159	76	83	1653	1660	10.3	8.6
609.1	9	2	7	159	76	83	1659	1667	10.3	12.0
610.2	9	2	7	159	76	83	1665	1673	10.3	10.3
611.2	9	2	7	159	76	83	1671	1679	10.3	10.3
612.2	9	2	7	159	76	83	1677	1685	10.3	10.3
613.2	9	2	7	159	76	83	1682	1691	8.6	10.3
614.3	9	2	7	159	76	83	1688	1697	10.3	10.3

TIME SEC.	R+ CNTS	R- CNTS	TOTAL R CNTS	B+ CNTS	B- CNTS	TOTAL B CNTS	ORF CNTS	OLR CNTS	SPEED-RF KM/HR.	SPEED-L KM/HR.
615.3	9	2	7	159	76	83	1694	1705	10.3	10.3
616.3	9	2	7	159	76	83	1700	1709	10.3	10.3
617.3	9	2	7	160	76	84	1706	1715	10.3	10.3
618.3	9	2	7	160	77	83	1712	1721	10.3	10.3
619.4	9	2	7	160	77	83	1716	1727	6.8	10.3
620.4	9	2	7	160	77	83	1720	1731	6.8	6.8
621.4	9	2	7	161	77	84	1725	1735	8.6	6.8
622.4	9	2	7	161	77	84	1729	1739	6.8	6.8
623.5	9	2	7	161	77	84	1734	1744	8.6	8.6
624.5	10	2	8	161	77	84	1739	1748	8.6	6.8
625.5	10	2	8	161	77	84	1744	1753	8.6	8.6
626.5	10	2	8	161	77	84	1749	1757	8.6	6.8
627.6	10	2	8	161	77	84	1755	1762	10.3	8.6
628.6	10	2	8	161	77	84	1760	1767	8.6	8.6
629.6	10	2	8	161	77	84	1765	1772	8.6	8.6
630.6	10	2	8	161	77	84	1770	1777	8.6	8.6
631.7	10	2	8	161	77	84	1775	1782	8.6	8.6
632.7	10	2	8	161	77	84	1780	1788	8.6	10.3
633.7	10	2	8	161	78	83	1787	1794	12.0	10.3
634.7	10	2	8	162	78	84	1792	1799	8.6	8.6
635.7	10	2	8	162	78	84	1797	1804	8.6	8.6
636.8	10	2	8	162	79	83	1802	1810	8.6	10.3
637.8	10	2	8	162	79	83	1807	1815	8.6	8.6
638.8	10	2	8	162	79	83	1812	1820	8.6	8.6
639.8	10	2	8	162	79	83	1817	1826	8.6	10.3
640.9	10	2	8	162	79	83	1824	1832	12.0	10.3
641.9	10	2	8	162	79	83	1829	1838	8.6	10.3
642.9	10	2	8	162	79	83	1835	1844	10.3	10.3
643.9	10	2	8	162	79	83	1840	1850	8.6	10.3
645.0	10	2	8	162	79	83	1845	1855	8.6	8.6
646.0	10	2	8	162	79	83	1851	1861	10.3	10.3
647.0	10	2	8	162	79	83	1856	1867	8.6	10.3
648.0	10	2	8	162	79	83	1861	1872	8.6	8.6
649.1	10	2	8	163	80	83	1867	1877	10.3	8.6
650.1	10	2	8	163	80	83	1872	1883	8.6	10.3
651.1	10	2	8	163	80	83	1877	1888	8.6	8.6
652.1	10	2	8	163	81	82	1882	1893	8.6	8.6
653.2	10	2	8	164	81	83	1888	1898	10.3	8.6
654.2	10	2	8	164	82	82	1893	1904	8.6	10.3
655.2	10	2	8	164	82	82	1898	1909	8.6	8.6
656.2	10	2	8	164	82	82	1903	1916	8.6	12.0
657.2	10	2	8	165	82	83	1907	1921	6.8	8.6
658.3	10	2	8	165	83	82	1912	1925	8.6	6.8
659.3	10	2	8	166	83	83	1917	1930	8.6	8.6
660.3	10	2	8	166	84	82	1922	1935	8.6	8.6
661.3	10	2	8	167	84	83	1927	1940	8.6	8.6
662.4	10	2	8	167	85	82	1932	1945	8.6	8.6
663.4	10	2	8	167	85	82	1939	1952	12.0	12.0
664.4	10	2	8	167	85	82	1943	1957	6.8	8.6
665.4	10	2	8	167	85	82	1948	1962	8.6	8.6
666.5	10	2	8	167	85	82	1953	1967	8.6	8.6
667.5	10	2	8	167	85	82	1958	1973	8.6	10.3
668.5	11	2	9	167	86	81	1964	1979	10.3	10.3
669.5	11	2	9	168	86	82	1970	1985	10.3	10.3
670.6	11	2	9	168	86	82	1975	1990	8.6	8.6
671.6	11	2	9	169	87	82	1981	1995	10.3	8.6
672.6	11	2	9	169	87	82	1985	2001	6.8	10.3
673.6	11	2	9	169	87	82	1990	2007	8.6	10.3
674.7	11	2	9	169	87	82	1996	2012	10.3	8.6
675.7	11	2	9	169	87	82	2001	2018	8.6	10.3

TIME SEC.	R+ CNTS	R- CNTS	TOTAL R CNTS	B+ CNTS	B- CNTS	TOTAL B CNTS	ORF CNTS	OLR CNTS	SPEED-RF KM/HR.	SPEED-T KM/HR.
676.7	11	2	9	169	87	82	2007	2024	10.3	10.3
677.7	11	2	9	169	87	82	2013	2031	10.3	12.0
678.7	11	2	9	169	87	82	2020	2037	12.0	10.3
679.8	11	2	9	169	87	82	2025	2043	8.6	10.3
680.8	11	2	9	169	87	82	2031	2048	10.3	8.6
681.8	11	2	9	169	87	82	2037	2054	10.3	10.3
682.8	11	2	9	169	87	82	2042	2059	8.6	8.6
683.9	11	2	9	169	87	82	2048	2065	10.3	10.3
684.9	11	2	9	169	87	82	2054	2071	10.3	10.3
685.9	11	2	9	169	87	82	2060	2077	10.3	10.3
686.9	11	2	9	169	87	82	2065	2083	8.6	10.3
688.0	11	2	9	169	87	82	2071	2088	10.3	8.6
689.0	11	2	9	169	87	82	2076	2094	8.6	10.3
690.0	11	2	9	169	87	82	2081	2100	8.6	10.3
691.0	11	2	9	169	87	82	2086	2105	8.6	8.6
692.1	11	2	9	169	87	82	2091	2111	8.6	10.3
693.1	11	2	9	170	87	83	2097	2116	10.3	8.6
694.1	11	2	9	170	88	82	2102	2121	8.6	8.6
695.1	11	2	9	171	88	83	2108	2127	10.3	10.3
696.2	11	2	9	171	89	82	2113	2133	8.6	10.3
697.2	11	2	9	172	89	83	2119	2138	10.3	8.6
698.2	11	2	9	172	90	82	2124	2143	8.6	8.6
699.2	11	2	9	172	90	82	2129	2148	8.6	8.6
700.2	11	2	9	172	90	82	2134	2154	8.6	10.3
701.3	11	2	9	172	90	82	2140	2160	10.3	10.3
702.3	11	2	9	172	90	82	2146	2165	10.3	8.6
703.3	11	2	9	173	90	83	2153	2172	12.0	12.0
704.3	11	2	9	173	91	82	2159	2179	10.3	12.0
705.4	11	2	9	174	91	83	2166	2186	12.0	12.0
706.4	12	2	10	174	91	83	2172	2192	10.3	10.3
707.4	12	2	10	174	91	83	2178	2199	10.3	12.0
708.4	12	2	10	174	91	83	2184	2205	10.3	10.3
709.5	12	2	10	174	92	82	2190	2211	10.3	10.3
710.5	12	2	10	175	92	83	2196	2217	10.3	10.3
711.5	12	2	10	175	93	82	2202	2223	10.3	10.3
712.5	12	2	10	175	93	82	2208	2228	10.3	8.6
713.6	12	2	10	176	93	83	2213	2233	8.6	8.6
714.6	12	2	10	176	94	82	2217	2238	6.8	8.6
715.6	12	2	10	177	94	83	2221	2243	6.8	8.6
716.6	12	2	10	177	94	83	2225	2247	6.8	6.8
717.6	12	2	10	177	94	83	2229	2251	6.8	6.8
718.7	12	2	10	177	94	83	2232	2255	5.1	6.8
719.7	12	2	10	177	94	83	2236	2259	6.8	6.8
720.7	12	2	10	177	94	83	2239	2262	5.1	5.1
721.7	12	2	10	177	94	83	2242	2265	5.1	5.1
722.8	12	2	10	177	94	83	2246	2269	6.8	6.8
723.8	12	2	10	177	94	83	2251	2275	8.6	10.3
724.8	12	2	10	177	94	83	2256	2280	8.6	8.6
725.8	12	2	10	178	94	84	2261	2284	8.6	6.8
726.9	12	2	10	178	95	83	2266	2289	8.6	8.6
727.9	12	2	10	178	95	83	2274	2295	13.7	10.3
728.9	12	2	10	178	95	83	2278	2300	6.8	8.6
729.9	12	2	10	178	95	83	2285	2306	12.0	10.3
731.0	12	2	10	178	95	83	2289	2310	6.8	6.8
732.0	12	2	10	178	95	83	2294	2315	8.6	8.6
733.0	12	2	10	178	95	83	2299	2320	8.6	8.6
734.0	12	2	10	179	96	83	2304	2325	8.6	8.6
735.1	12	2	10	179	96	83	2310	2330	10.3	8.6
736.1	12	2	10	179	96	83	2315	2336	8.6	10.3
737.1	12	2	10	179	96	83	2321	2342	10.3	10.3

TIME SEC.	R+ CNTS	R- CNTS	TOTAL R CNTS	B+ CNTS	B- CNTS	TOTAL B CNTS	ORF CNTS	OLR CNTS	SPEED-RF KM/HR.	SPEED-L KM/HR.
738.1	12	2	10	179	96	83	2326	2348	8.6	10.3
739.1	12	2	10	179	96	83	2333	2354	12.0	10.3
740.2	12	2	10	179	96	83	2339	2360	10.3	10.3
741.2	12	2	10	179	96	83	2344	2366	8.6	10.3
742.2	12	2	10	179	97	82	2350	2372	10.3	10.3
743.2	12	2	10	179	97	82	2356	2378	10.3	10.3
744.3	12	2	10	179	97	82	2361	2384	8.6	10.3
745.3	12	2	10	180	97	83	2367	2391	10.3	12.0
746.3	12	2	10	180	98	82	2372	2396	8.6	8.6
747.3	12	2	10	181	98	83	2377	2401	8.6	8.6
748.4	12	2	10	181	98	83	2381	2405	6.8	6.8
749.4	12	2	10	181	98	83	2385	2409	6.8	6.8
750.4	13	2	11	181	99	82	2389	2414	6.8	8.6
751.4	13	2	11	182	99	83	2394	2417	8.6	5.1
752.5	13	2	11	182	99	83	2397	2421	5.1	6.8
753.5	13	2	11	182	100	82	2404	2426	12.0	8.6
754.5	13	2	11	183	100	83	2408	2429	6.8	5.1
755.5	13	2	11	183	100	83	2413	2433	6.6	6.8
756.6	13	2	11	183	101	82	2417	2438	6.8	8.6
757.6	13	2	11	183	101	82	2421	2443	6.8	8.6
758.6	13	2	11	183	101	82	2426	2448	8.6	8.6
759.6	13	2	11	183	101	82	2430	2452	6.8	6.8
760.6	13	2	11	183	101	82	2435	2457	8.6	8.6
761.7	13	2	11	183	101	82	2440	2462	8.6	8.6
762.7	13	2	11	183	101	82	2445	2467	8.6	8.6
763.7	13	2	11	183	101	82	2450	2472	8.6	8.6
764.7	13	2	11	183	101	82	2456	2478	10.3	10.3
765.8	13	2	11	183	101	82	2460	2483	6.8	8.6
766.8	13	2	11	183	101	82	2465	2487	8.6	6.8
767.8	13	2	11	183	101	82	2470	2493	8.6	10.3
768.8	13	2	11	183	101	82	2475	2498	8.6	8.6
769.9	13	2	11	183	101	82	2481	2503	10.3	8.6
770.9	13	2	11	183	102	81	2485	2508	6.8	8.6
771.9	13	2	11	184	102	82	2490	2513	8.6	8.6
772.9	13	2	11	184	103	81	2495	2517	8.6	6.8
774.0	13	2	11	184	103	81	2501	2523	10.3	10.3
775.0	13	2	11	185	103	82	2506	2528	8.6	8.6
776.0	13	2	11	185	103	82	2511	2533	8.6	8.6
777.0	13	2	11	185	103	82	2516	2538	8.6	8.6
778.1	13	2	11	185	104	81	2522	2544	10.3	10.3
779.1	13	2	11	185	104	81	2527	2549	8.6	8.6
780.1	13	2	11	185	104	81	2532	2555	8.6	10.3
781.1	13	2	11	185	104	81	2537	2561	8.6	10.3
782.1	13	2	11	185	104	81	2542	2566	8.6	8.6
783.2	13	2	11	185	104	81	2547	2571	8.6	8.6
784.2	13	2	11	185	104	81	2552	2576	8.6	8.6
785.2	13	2	11	185	104	81	2558	2582	10.3	10.3
786.2	13	2	11	185	104	81	2563	2587	8.6	8.6
787.3	13	2	11	185	104	81	2569	2593	10.3	10.3
788.3	13	2	11	185	104	81	2575	2599	10.3	10.3
789.3	13	2	11	185	104	81	2580	2605	8.6	10.3
790.3	13	2	11	185	104	81	2586	2611	10.3	10.3
791.4	13	2	11	185	104	81	2592	2617	10.3	10.3
792.4	13	2	11	185	104	81	2598	2623	10.3	10.3
793.4	13	2	11	185	104	81	2604	2630	10.3	12.0
794.4	13	2	11	185	104	81	2610	2636	10.3	10.3
795.5	13	2	11	185	104	81	2616	2642	10.3	10.3
796.5	14	2	12	185	104	81	2622	2648	10.3	10.3
797.5	14	2	12	185	104	81	2628	2653	10.3	8.6
798.5	14	2	12	185	104	81	2634	2659	10.3	10.3

TIME SEC.	R+ CNTS	R- CNTS	TOTAL R CNTS	B+ CNTS	B- CNTS	TOTAL B CNTS	ORF CNTS	OLR CNTS	SPEED-RF KM/HR.	SPEED-I KM/HR.
799.5	14	2	12	185	104	81	2640	2664	10.3	8.6
800.6	14	2	12	185	104	81	2646	2670	10.3	10.3
801.6	14	2	12	185	104	81	2651	2676	8.6	10.3
802.6	14	2	12	185	104	81	2658	2683	12.0	12.0
803.6	14	2	12	185	104	81	2663	2688	8.6	8.6
804.7	14	2	12	185	104	81	2668	2693	8.6	8.6
805.7	14	2	12	185	104	81	2673	2698	8.6	8.6
806.7	14	2	12	185	104	81	2678	2704	8.6	10.3
807.7	14	2	12	185	104	81	2684	2710	10.3	10.3
808.8	14	2	12	185	104	81	2690	2716	10.3	10.3
809.8	14	2	12	185	104	81	2695	2722	8.6	10.3
810.8	14	2	12	185	104	81	2701	2728	10.3	10.3
811.8	14	2	12	185	104	81	2707	2733	10.3	8.6
812.9	14	2	12	185	104	81	2713	2739	10.3	10.3
813.9	14	2	12	185	104	81	2719	2745	10.3	10.3
814.9	14	2	12	185	104	81	2725	2752	10.3	12.0
815.9	14	2	12	185	104	81	2731	2758	10.3	10.3
817.0	14	2	12	185	104	81	2737	2764	10.3	10.3
818.0	14	2	12	185	104	81	2743	2770	10.3	10.3
819.0	14	2	12	185	104	81	2749	2776	10.3	10.3
820.0	14	2	12	185	104	81	2755	2780	10.3	6.8
821.0	14	2	12	185	104	81	2761	2785	10.3	8.6
822.1	14	2	12	185	104	81	2766	2791	8.6	10.3
823.1	14	2	12	185	104	81	2772	2797	10.3	10.3
824.1	14	2	12	185	104	81	2777	2802	8.6	8.6
825.1	14	2	12	185	105	80	2783	2808	10.3	10.3
826.2	14	2	12	186	105	81	2789	2814	10.3	10.3
827.2	14	2	12	186	106	80	2795	2821	10.3	12.0
828.2	14	2	12	186	106	80	2802	2828	12.0	12.0
829.2	14	2	12	186	106	80	2808	2834	10.3	10.3
830.3	14	2	12	186	106	80	2814	2841	10.3	12.0
831.3	14	2	12	186	106	80	2820	2847	10.3	10.3
832.3	14	2	12	186	106	80	2827	2854	12.0	12.0
833.3	14	2	12	186	106	80	2833	2860	10.3	10.3
834.4	15	2	13	186	106	80	2838	2866	8.6	10.3
835.4	15	2	13	186	106	80	2844	2872	10.3	10.3
836.4	15	2	13	186	106	80	2849	2878	8.6	10.3
837.4	15	2	13	186	106	80	2855	2883	10.3	8.6
838.5	15	2	13	186	106	80	2860	2890	8.6	12.0
839.5	15	2	13	186	106	80	2866	2896	10.3	10.3
840.5	15	2	13	186	106	80	2872	2903	10.3	12.0
841.5	15	2	13	187	106	81	2878	2908	10.3	8.6
842.5	15	2	13	187	106	81	2883	2915	8.6	12.0
843.6	15	2	13	187	106	81	2890	2920	12.0	8.6
844.6	15	2	13	187	106	81	2894	2924	6.8	6.8
845.6	15	2	13	187	106	81	2898	2927	6.8	5.1
846.6	15	2	13	187	106	81	2904	2931	10.3	6.8
847.7	15	2	13	187	106	81	2908	2934	6.8	5.1
848.7	15	2	13	187	106	81	2912	2938	6.8	6.8
849.7	15	2	13	187	106	81	2915	2941	5.1	5.1
850.7	15	2	13	187	106	81	2918	2944	5.1	5.1
851.8	15	2	13	187	106	81	2920	2947	3.4	5.1
852.8	15	2	13	187	106	81	2923	2949	5.1	3.4
853.8	15	2	13	187	106	81	2926	2952	5.1	5.1
854.8	15	2	13	187	106	81	2929	2956	5.1	6.8
855.9	15	2	13	187	106	81	2932	2959	5.1	5.1
856.9	15	2	13	187	107	80	2936	2963	10.3	6.8
857.9	15	2	13	188	107	81	2941	2967	5.1	6.8
858.9	15	2	13	188	108	80	2945	2971	6.8	6.8
860.0	15	2	13	188	108	80	2949	2975	6.8	6.8

TIME SEC.	R+ CNTS	R- CNTS	TOTAL R CNTS	L+ CNTS	L- CNTS	TOTAL L CNTS	ORF CNTS	OLR CNTS	SPEED-RF KM/HR.	SPEED-LF KM/HR.
861.0	15	2	13	188	108	80	2953	2960	6.8	6.6
862.0	15	2	13	189	108	81	2958	2965	8.6	8.6
863.0	15	2	13	189	108	81	2962	2969	6.8	6.8
864.0	15	2	13	189	109	80	2968	2974	10.3	8.6
865.1	15	2	13	190	109	81	2972	2978	6.8	6.8
866.1	15	2	13	190	109	81	2977	3002	8.6	6.8
867.1	15	2	13	190	109	81	2981	3007	6.8	8.6
868.1	15	2	13	191	110	81	2986	3011	8.6	6.8
869.2	15	2	13	191	110	81	2990	3016	6.8	8.6
870.2	15	2	13	191	111	80	2995	3022	8.6	10.3
871.2	15	2	13	192	111	81	3000	3027	8.6	8.6
872.2	15	2	13	192	111	81	3006	3032	10.3	8.6
873.3	15	2	13	192	111	81	3011	3037	8.6	8.6
874.3	15	2	13	192	111	81	3016	3043	8.6	10.3
875.3	15	2	13	192	112	80	3021	3048	8.6	8.6
876.3	15	2	13	193	112	81	3027	3054	10.3	10.3
877.4	15	2	13	193	113	80	3033	3060	10.3	10.3
878.4	15	2	13	194	113	81	3039	3066	10.3	10.3
879.4	15	2	13	194	113	81	3044	3072	8.6	10.3
880.4	16	2	14	194	113	81	3050	3078	10.3	10.3
881.4	16	2	14	194	113	81	3055	3083	8.6	8.6
882.5	16	2	14	194	113	81	3061	3089	10.3	10.3
883.5	16	2	14	194	113	81	3066	3094	8.6	8.6
884.5	16	2	14	194	113	81	3072	3099	10.3	8.6
885.5	16	2	14	194	113	81	3077	3105	8.6	10.3
886.6	16	2	14	194	113	81	3082	3111	8.6	10.3
887.6	16	2	14	194	113	81	3088	3116	10.3	8.6
888.6	16	2	14	194	113	81	3093	3122	8.6	10.3
889.6	16	2	14	194	113	81	3099	3127	10.3	8.6
890.7	16	2	14	194	113	81	3104	3132	8.6	8.6
891.7	16	2	14	194	113	81	3110	3137	10.3	8.6
892.7	16	2	14	194	113	81	3115	3142	8.6	8.6
893.7	16	2	14	194	113	81	3121	3148	10.3	10.3
894.8	16	2	14	194	113	81	3126	3153	8.6	8.6
895.8	16	2	14	194	113	81	3131	3158	8.6	8.6
896.8	16	2	14	194	113	81	3136	3163	8.6	8.6
897.8	16	2	14	194	113	81	3140	3168	6.8	8.6
898.9	16	2	14	194	113	81	3145	3172	8.6	6.8
899.9	16	2	14	194	113	81	3150	3177	8.6	8.6
900.9	16	2	14	194	113	81	3155	3183	8.6	10.3
901.9	16	2	14	194	113	81	3161	3188	10.3	8.6
902.9	16	2	14	194	113	81	3167	3194	10.3	10.3
904.0	16	2	14	194	113	81	3173	3201	10.3	12.0
905.0	16	2	14	194	113	81	3180	3207	12.0	10.3
906.0	16	2	14	194	113	81	3186	3214	10.3	12.0
907.0	16	2	14	194	113	81	3193	3221	12.0	12.0
908.1	16	2	14	194	113	81	3198	3227	8.6	10.3
909.1	16	2	14	194	113	81	3204	3232	10.3	8.6
910.1	16	2	14	194	113	81	3209	3237	8.6	8.6
911.1	16	2	14	194	113	81	3215	3243	10.3	10.3
912.2	16	2	14	194	113	81	3219	3248	6.8	8.6
913.2	16	2	14	194	113	81	3225	3254	10.3	10.3
914.2	16	2	14	194	113	81	3230	3260	8.6	10.3
915.2	16	2	14	194	113	81	3236	3265	10.3	8.6
916.3	16	2	14	194	113	81	3241	3270	8.6	8.6
917.3	16	2	14	194	113	81	3247	3276	10.3	10.3
918.3	16	2	14	194	113	81	3253	3282	10.3	10.3
919.3	16	2	14	194	113	81	3260	3288	12.0	10.3
920.4	17	2	15	194	113	81	3266	3295	10.3	12.0
921.4	17	2	15	194	113	81	3273	3301	12.0	10.3

TIME SEC.	R+ CNTS	R- CNTS	TOTAL R CNTS	B+ CNTS	B- CNTS	TOTAL B CNTS	ORF CNTS	OLR CNTS	SPEED-FF KM/HR.	SPEED-L KM/HR.
922.4	17	2	15	194	113	81	3279	3307	10.3	10.3
923.4	17	2	15	194	113	81	3285	3314	10.3	12.0
924.4	17	2	15	194	113	81	3292	3321	12.0	12.0
925.5	17	2	15	194	113	81	3299	3327	12.0	10.3
926.5	17	2	15	194	113	81	3306	3334	12.0	12.0
927.5	17	2	15	194	113	81	3313	3341	12.0	12.0
928.5	17	2	15	194	114	80	3320	3348	12.0	12.0
929.6	17	2	15	195	115	80	3327	3355	12.0	12.0
930.6	17	2	15	195	115	80	3335	3362	13.7	12.0
931.6	17	2	15	195	115	80	3342	3370	12.0	13.7
932.6	17	2	15	195	115	80	3349	3377	12.0	12.0
933.7	17	2	15	195	115	80	3356	3384	12.0	12.0
934.7	17	2	15	195	115	80	3363	3390	12.0	10.3
935.7	17	2	15	195	115	80	3369	3397	10.3	12.0
936.7	17	2	15	195	115	80	3376	3404	12.0	12.0
937.8	17	2	15	195	115	80	3383	3409	12.0	[illegible]
938.8	17	2	15	195	115	80	3389	3415	10.3	10.3
939.8	17	2	15	195	115	80	3395	3422	10.3	12.0
940.8	17	2	15	195	115	80	3402	3428	12.0	10.3
941.9	17	2	15	195	115	80	3408	3433	10.3	8.6
942.9	17	2	15	195	115	80	3414	3438	10.3	8.6
943.9	17	2	15	195	116	79	3419	3443	8.6	8.6
944.9	17	2	15	196	117	79	3426	3449	12.0	10.3
945.9	17	2	15	196	117	79	3432	3456	10.3	12.0
947.0	17	2	15	196	117	79	3438	3462	10.3	10.3
948.0	17	2	15	196	117	79	3445	3470	12.0	13.7
949.0	17	2	15	196	117	79	3450	3476	8.6	10.3
950.0	17	2	15	196	117	79	3457	3483	12.0	12.0
951.1	17	2	15	196	117	79	3463	3490	10.3	12.0
952.1	17	2	15	196	117	79	3470	3496	12.0	10.3
953.1	17	2	15	196	117	79	3477	3503	12.0	12.0
954.1	17	2	15	196	117	79	3483	3510	10.3	12.0
955.2	17	2	15	196	117	79	3489	3517	10.3	12.0
956.2	17	2	15	196	117	79	3496	3524	12.0	12.0
957.2	18	2	16	196	117	79	3502	3530	10.3	10.3
958.2	18	3	15	196	118	78	3508	3536	10.3	10.3
959.3	18	3	15	196	118	78	3514	3542	10.3	10.3
960.3	19	3	16	196	118	78	3521	3548	12.0	10.3
961.3	19	3	16	196	118	78	3527	3554	10.3	10.3
962.3	19	3	16	196	118	78	3533	3561	10.3	12.0
963.3	19	3	16	196	118	78	3540	3568	12.0	12.0
964.4	19	3	16	196	118	78	3548	3575	13.7	12.0
965.4	19	3	16	196	118	78	3554	3581	10.3	10.3
966.4	19	3	16	196	118	78	3559	3588	8.6	12.0
967.4	19	3	16	196	118	78	3565	3592	10.3	6.8
968.5	19	3	16	196	118	78	3573	3599	13.7	12.0
969.5	19	3	16	196	118	78	3579	3604	10.3	8.6
970.5	19	3	16	196	118	78	3585	3611	10.3	12.0
971.5	19	3	16	196	118	78	3592	3617	12.0	10.3
972.6	19	3	16	196	118	78	3597	3624	8.6	12.0
973.6	19	3	16	196	118	78	3603	3630	10.3	10.3
974.6	19	3	16	196	118	78	3610	3637	12.0	12.0
975.6	19	3	16	196	118	78	3617	3644	12.0	12.0
976.7	19	3	16	196	118	78	3624	3650	12.0	10.3
977.7	19	3	16	196	118	78	3631	3657	12.0	12.0
978.7	19	3	16	196	118	78	3638	3665	12.0	13.7
979.7	19	3	16	196	118	78	3645	3671	12.0	10.3
980.8	19	3	16	196	118	78	3654	3679	15.5	13.7
981.8	19	3	16	196	118	78	3662	3686	13.7	12.0
982.8	19	3	16	196	118	78	3668	3691	10.3	8.6

TIME SEC.	R+ CNTS	R- CNTS	TOTAL R CNTS	B+ CNTS	B- CNTS	TOTAL B CNTS	ORF CNTS	OLR CNTS	SPEED-RF KM/HR.	SPEED-LR KM/HR.
983.8	19	3	16	196	118	78	3673	3697	8.6	10.3
984.8	19	3	16	196	118	78	3678	3702	8.6	8.6
985.9	19	3	16	196	118	78	3683	3708	8.6	10.3
986.9	19	3	16	196	118	78	3688	3714	8.6	10.3
987.9	19	3	16	196	118	78	3693	3720	8.6	10.3
988.9	19	3	16	196	118	78	3698	3725	8.6	8.6
990.0	19	3	16	196	118	78	3704	3731	10.3	10.3
991.0	19	3	16	196	118	78	3709	3737	8.6	10.3
992.0	19	3	16	196	118	78	3714	3743	8.6	10.3
993.0	19	3	16	196	118	78	3721	3749	12.0	10.3
994.1	19	3	16	196	118	78	3727	3756	10.3	12.0
995.1	19	3	16	196	118	78	3733	3762	10.3	10.3
996.1	20	3	17	196	118	78	3740	3769	12.0	12.0
997.1	20	3	17	196	118	78	3746	3776	10.3	12.0
998.2	20	3	17	196	118	78	3752	3782	10.3	10.3
999.2	20	3	17	196	118	78	3757	3788	8.6	10.3
1000.2	20	3	17	196	118	78	3763	3794	10.3	10.3
1001.2	20	3	17	196	118	78	3769	3800	10.3	10.3
1002.3	20	3	17	196	118	78	3775	3806	10.3	10.3
1003.3	20	3	17	196	118	78	3781	3811	10.3	8.6
1004.3	20	3	17	196	118	78	3788	3818	12.0	12.0
1005.3	20	3	17	196	118	78	3793	3823	8.6	8.6
1006.3	20	3	17	196	118	78	3799	3828	10.3	8.6
1007.4	20	3	17	196	118	78	3804	3834	8.6	10.3
1008.4	20	3	17	196	118	78	3809	3840	8.6	10.3
1009.4	20	3	17	196	118	78	3814	3846	8.6	10.3
1010.4	20	3	17	196	118	78	3819	3850	8.6	6.8
1011.5	20	3	17	196	118	78	3823	3855	6.8	8.6
1012.5	20	3	17	196	118	78	3828	3860	8.6	8.6
1013.5	20	3	17	196	118	78	3833	3865	8.6	8.6
1014.5	20	3	17	196	118	78	3837	3870	6.8	8.6
1015.6	20	3	17	196	118	78	3842	3876	8.6	10.3
1016.6	20	3	17	196	118	78	3847	3881	8.6	8.6
1017.6	20	3	17	196	118	78	3853	3887	10.3	10.3
1018.6	20	3	17	196	118	78	3858	3892	8.6	8.6
1019.7	20	3	17	196	118	78	3864	3898	10.3	10.3
1020.7	20	3	17	196	118	78	3869	3903	8.6	8.6
1021.7	20	3	17	197	118	79	3874	3908	8.6	8.6
1022.7	20	3	17	197	118	79	3879	3913	8.6	8.6
1023.8	20	3	17	197	118	79	3883	3918	6.8	8.6
1024.8	20	3	17	197	118	79	3887	3922	6.8	6.8
1025.8	20	3	17	197	118	79	3891	3927	6.8	8.6
1026.8	20	3	17	197	118	79	3895	3931	6.8	6.8
1027.8	20	3	17	197	118	79	3900	3936	8.6	8.6
1028.9	20	3	17	197	118	79	3905	3941	8.6	8.6
1029.9	20	3	17	197	118	79	3911	3947	10.3	10.3
1030.9	20	3	17	197	118	79	3917	3953	10.3	10.3
1031.9	20	3	17	197	118	79	3923	3958	10.3	8.6
1033.0	20	3	17	197	118	79	3930	3965	12.0	12.0
1034.0	20	3	17	197	118	79	3935	3971	8.6	10.3
1035.0	20	3	17	197	118	79	3941	3976	10.3	8.6
1036.0	20	3	17	197	118	79	3947	3981	10.3	8.6
1037.1	20	3	17	197	118	79	3952	3985	8.6	6.8
1038.1	20	3	17	197	118	79	3958	3990	10.3	8.6
1039.1	20	3	17	197	118	79	3963	3996	8.6	10.3
1040.1	20	3	17	197	118	79	3969	4001	10.3	8.6
1041.2	20	3	17	198	118	80	3976	4007	12.0	10.3
1042.2	21	3	18	198	118	80	3981	4013	8.6	10.3
1043.2	22	4	18	198	119	79	3988	4018	12.0	8.6
1044.2	22	4	18	198	119	79	3994	4025	10.3	12.0

TIME SEC.	R+ CNTS	R- CNTS	TOTAL R CNTS	B+ CNTS	B- CNTS	TOTAL B CNTS	ORF CNTS	OLR CNTS	SPEED-RF KM/HR.	SPEED-L KM/HR.
1045.2	22	4	18	198	119	79	4000	4031	10.3	10.3
1046.3	22	4	18	198	119	79	4006	4037	10.3	10.3
1047.3	22	4	18	198	119	79	4012	4043	10.3	10.3
1048.3	22	4	18	198	119	79	4017	4048	8.6	8.6
1049.3	22	4	18	198	119	79	4023	4053	10.3	8.6
1050.4	22	4	18	198	119	79	4028	4058	8.6	8.6
1051.4	22	4	18	198	119	79	4034	4064	10.3	10.3
1052.4	22	4	18	198	119	79	4039	4070	8.6	10.3
1053.4	22	4	18	198	119	79	4045	4076	10.3	10.3
1054.5	22	4	18	198	119	79	4051	4082	10.3	10.3
1055.5	22	4	18	198	119	79	4058	4088	12.0	10.3
1056.5	22	4	18	198	119	79	4063	4094	8.6	10.3
1057.5	22	4	18	198	119	79	4069	4100	10.3	10.3
1058.6	22	4	18	198	119	79	4074	4106	8.6	10.3
1059.6	22	4	18	198	119	79	4081	4112	12.0	10.3
1060.6	22	4	18	198	119	79	4086	4117	8.6	8.6
1061.6	22	4	18	198	119	79	4091	4122	8.6	8.6
1062.7	22	4	18	198	119	79	4096	4128	8.6	10.3
1063.7	22	4	18	198	119	79	4101	4132	8.6	6.8
1064.7	22	4	18	198	119	79	4106	4137	8.6	8.6
1065.7	22	4	18	198	119	79	4111	4141	8.6	6.8
1066.7	22	4	18	198	119	79	4116	4146	8.6	8.6
1067.8	22	4	18	198	119	79	4120	4151	6.8	8.6
1068.8	22	4	18	198	119	79	4124	4156	6.8	8.6
1069.8	22	4	18	198	119	79	4127	4160	5.1	6.8
1070.8	22	4	18	198	119	79	4131	4164	6.8	6.8
1071.9	22	4	18	198	119	79	4135	4169	6.8	8.6
1072.9	22	4	18	198	119	79	4139	4173	6.8	6.8
1073.9	22	4	18	198	119	79	4144	4177	8.6	8.6
1074.9	22	4	18	198	119	79	4149	4182	8.6	8.6
1076.0	22	4	18	198	119	79	4153	4186	6.8	6.8
1077.0	22	4	18	198	119	79	4159	4192	10.3	10.3
1078.0	22	4	18	198	119	79	4163	4195	6.8	5.1
1079.0	22	4	18	198	119	79	4166	4198	5.1	5.1
1080.1	22	4	18	198	119	79	4169	4202	5.1	6.8
1081.1	22	4	18	198	119	79	4174	4206	8.6	6.8
1082.1	22	4	18	198	119	79	4178	4210	6.8	6.8
1083.1	22	4	18	198	119	79	4182	4213	6.8	5.1
1084.2	22	4	18	198	119	79	4186	4217	6.8	6.8
1085.2	22	4	18	198	119	79	4190	4221	6.8	6.8
1086.2	22	4	18	198	119	79	4195	4225	8.6	6.8
1087.2	22	4	18	198	119	79	4199	4229	6.8	6.8
1088.2	23	4	19	198	119	79	4203	4233	6.8	6.8
1089.3	23	4	19	198	119	79	4207	4237	6.8	6.8
1090.3	23	4	19	198	119	79	4211	4241	6.8	6.8
1091.3	23	4	19	198	119	79	4216	4246	8.6	8.6
1092.3	23	4	19	198	119	79	4221	4250	8.6	6.8
1093.4	23	4	19	198	119	79	4225	4254	6.8	6.8
1094.4	23	4	19	198	119	79	4229	4259	6.8	8.6
1095.4	23	4	19	198	119	79	4233	4263	6.8	6.8
1096.4	23	4	19	198	119	79	4238	4268	8.6	8.6
1097.5	23	4	19	198	119	79	4242	4272	6.8	6.8
1098.5	23	4	19	198	119	79	4247	4276	8.6	6.8
1099.5	23	4	19	198	119	79	4251	4280	6.8	6.8
1100.5	23	4	19	198	119	79	4255	4283	6.8	5.1
1101.6	23	4	19	198	119	79	4258	4287	5.1	6.8
1102.6	23	4	19	198	119	79	4262	4291	6.8	6.8
1103.6	23	4	19	198	119	79	4267	4295	8.6	6.8
1104.6	23	4	19	198	120	78	4272	4300	8.6	8.6
1105.7	23	4	19	198	120	78	4277	4306	8.6	10.3

TIME SEC.	R+ CNTS	R- CNTS	TOTAL R CNTS	E+ CNTS	E- CNTS	TOTAL E CNTS	ORF CNTS	OLR CNTS	SPEED-RF KM/HR.	SPEED-L KM/HR.
1106.7	23	4	19	198	120	78	4282	4311	8.6	8.6
1107.7	23	4	19	198	120	78	4286	4316	8.6	8.6
1108.7	23	4	19	198	120	78	4291	4321	8.6	8.6
1109.7	23	4	19	198	120	78	4295	4326	6.8	8.6
1110.8	23	4	19	198	120	78	4299	4329	6.8	8.1
1111.8	23	4	19	198	120	78	4303	4333	6.8	8.8
1112.8	23	4	19	198	120	79	4307	4337	6.8	8.8
1113.8	23	4	19	198	120	78	4311	4341	6.8	8.8
1114.9	23	4	19	198	120	78	4316	4345	8.6	8.8
1115.9	23	4	19	198	120	78	4321	4350	8.6	8.6
1116.9	23	4	19	198	120	78	4327	4356	10.3	10.3
1117.9	23	4	19	198	120	78	4332	4361	8.6	8.6
1119.0	23	4	19	198	120	78	4338	4367	10.3	10.3
1120.0	23	4	19	198	120	78	4344	4373	10.3	10.3
1121.0	23	4	19	198	120	78	4349	4379	8.6	10.3
1122.0	23	4	19	198	120	78	4355	4385	10.3	10.3
1123.1	23	4	19	198	120	78	4360	4391	8.6	10.3
1124.1	23	4	19	198	120	78	4365	4397	8.6	10.3
1125.1	23	4	19	198	120	78	4371	4403	10.3	10.3
1126.1	23	4	19	198	120	78	4376	4409	8.6	10.3
1127.1	23	4	19	198	120	78	4382	4414	10.3	8.6
1128.2	23	4	19	198	120	78	4388	4420	10.3	10.3
112..2	23	4	19	198	120	78	4394	4426	10.3	10.3
1130.2	23	4	19	198	120	78	4401	4432	12.0	10.3
1131.2	23	4	19	199	120	79	4406	4437	8.6	8.6
1132.3	23	4	19	199	121	78	4412	4443	10.3	10.3
1133.3	23	4	19	199	121	78	4417	4448	8.6	8.6
1134.3	23	4	19	199	121	78	4423	4454	10.3	10.3
1135.3	23	4	19	199	121	78	4429	4459	10.3	8.6
1136.4	23	4	19	199	121	78	4434	4465	8.6	10.3
1137.4	24	4	20	199	121	78	4440	4471	10.3	10.3
1138.4	24	4	20	199	121	78	4446	4476	10.3	8.6
1139.4	24	4	20	199	121	78	4451	4482	8.6	10.3
1140.5	24	4	20	199	121	78	4457	4488	10.3	10.3
1141.5	24	4	20	199	121	78	4463	4493	10.3	8.6
1142.5	24	4	20	199	121	78	4468	4499	8.6	10.3
1143.5	24	4	20	199	121	78	4474	4504	10.3	8.6
1144.6	24	4	20	199	121	78	4479	4510	8.6	10.3
1145.6	24	4	20	199	121	78	4485	4515	10.3	8.6
1146.6	24	4	20	199	121	78	4490	4521	8.6	10.3
1147.6	24	4	20	199	121	78	4495	4527	8.6	10.3
1148.6	24	4	20	199	121	78	4501	4533	10.3	10.3
1149.7	24	4	20	199	121	78	4506	4539	8.6	10.3
1150.7	24	4	20	199	121	78	4512	4545	10.3	10.3
1151.7	24	4	20	199	121	78	4517	4550	8.6	8.6
1152.7	24	4	20	199	121	78	4522	4555	8.6	8.6
1153.8	24	4	20	199	121	78	4526	4559	6.8	6.8
1154.8	24	4	20	199	121	78	4531	4565	8.6	10.3
1155.8	24	4	20	199	121	78	4536	4570	8.6	8.6
1156.8	24	4	20	199	121	78	4541	4575	8.6	8.6
1157.9	24	4	20	199	121	78	4547	4581	10.3	10.3
1158.9	24	4	20	199	121	78	4552	4587	8.6	10.3
1159.9	24	4	20	199	121	78	4559	4593	12.0	10.3
1160.9	24	4	20	199	121	78	4565	4599	10.3	10.3
1162.0	24	4	20	199	121	78	4570	4605	8.6	10.3
1163.0	24	4	20	199	121	78	4576	4610	10.3	8.6
1164.0	24	4	20	199	121	78	4582	4616	10.3	10.3
1165.0	24	4	20	199	121	78	4588	4622	10.3	10.3
1166.1	24	4	20	199	121	78	4594	4628	10.3	10.3
1167.1	24	4	20	199	121	78	4600	4634	10.3	10.3

TIME SEC.	R+ CNTS	R- CNTS	TOTAL R CNTS	L+ CNTS	L- CNTS	TOTAL L CNTS	ORF CNTS	OLR CNTS	SPEED-RF KM/HR.	SPEED-LR KM/HR.
1168.1	24	4	20	199	121	78	4606	4640	10.3	10.3
1169.1	24	4	20	199	121	78	4612	4647	10.3	12.0
1170.1	24	4	20	199	121	78	4618	4653	10.3	10.3
1171.2	24	4	20	199	121	78	4625	4660	12.0	12.0
1172.2	24	4	20	199	121	78	4632	4667	12.0	12.0
1173.2	24	4	20	199	121	78	4638	4673	10.3	10.3
1174.2	25	4	21	199	121	78	4645	4680	12.0	12.0
1175.3	25	4	21	199	121	78	4651	4687	10.3	12.0
1176.3	25	4	21	199	121	78	4658	4694	12.0	12.0
1177.3	25	4	21	199	121	78	4665	4701	12.0	12.0
1178.3	25	4	21	199	121	78	4671	4707	10.3	10.3
1179.4	25	4	21	199	121	78	4678	4713	12.0	10.3
1180.4	25	4	21	199	121	78	4684	4719	10.3	10.3
1181.4	25	4	21	199	121	78	4689	4725	8.6	10.3
1182.4	25	4	21	199	121	78	4694	4730	8.6	8.6
1183.5	25	4	21	199	121	78	4699	4735	8.6	8.6
1184.5	25	4	21	199	121	78	4705	4741	10.3	10.3
1185.5	25	4	21	199	121	78	4711	4747	10.3	10.3
1186.5	25	4	21	199	121	78	4717	4754	10.3	12.0
1187.6	25	4	21	199	121	78	4723	4760	10.3	10.3
1188.6	25	4	21	199	121	78	4729	4767	10.3	12.0
1189.6	25	4	21	199	121	78	4736	4774	12.0	12.0
1190.6	25	4	21	199	121	78	4743	4780	12.0	10.3
1191.6	25	4	21	199	121	78	4749	4787	10.3	12.0
1192.7	25	4	21	199	121	78	4756	4794	12.0	12.0
1193.7	25	4	21	199	121	78	4762	4799	10.3	8.6
1194.7	25	4	21	199	121	78	4768	4805	10.3	10.3
1195.7	25	4	21	200	121	79	4773	4811	8.6	10.3
1196.8	25	4	21	200	122	78	4779	4816	10.3	8.6
1197.8	25	4	21	201	122	79	4784	4821	8.6	8.6
1198.8	25	4	21	201	122	79	4789	4826	8.6	8.6
1199.8	25	4	21	201	122	79	4794	4831	8.6	8.6
1200.9	25	4	21	201	122	79	4799	4836	8.6	8.6
1201.9	25	4	21	201	122	79	4804	4842	8.6	10.3
1202.9	25	4	21	201	122	79	4809	4846	8.6	6.8
1203.9	25	4	21	201	122	79	4814	4851	8.6	8.6
1205.0	25	4	21	201	122	79	4819	4856	8.6	8.6
1206.0	25	4	21	201	122	79	4823	4860	6.8	6.8
1207.0	25	4	21	201	122	79	4828	4864	8.6	6.8
1208.0	25	4	21	201	122	79	4833	4870	8.6	10.3
1209.0	25	4	21	201	122	79	4838	4874	8.6	6.8
1210.1	25	4	21	201	122	79	4842	4879	8.8	8.6
1211.1	26	4	22	201	122	79	4847	4884	8.6	8.6
1212.1	26	4	22	201	122	79	4851	4888	6.8	6.8
1213.1	26	4	22	201	122	79	4856	4893	8.6	8.6
1214.2	26	4	22	201	122	79	4860	4898	6.8	8.6
1215.2	26	4	22	201	122	79	4866	4903	10.3	8.6
1216.2	26	4	22	201	122	79	4871	4909	8.6	10.3
1217.2	26	4	22	201	122	79	4876	4914	8.6	8.6
1218.3	26	4	22	201	122	79	4881	4919	8.6	8.6
1219.3	26	4	22	201	122	79	4886	4924	8.6	8.6
1220.3	26	4	22	201	122	79	4891	4929	8.6	8.6
1221.3	26	4	22	201	122	79	4896	4935	8.6	10.3
1222.4	26	4	22	201	122	79	4901	4941	8.6	10.3
1223.4	26	4	22	201	122	79	4907	4947	10.3	10.3
1224.4	26	4	22	201	122	79	4913	4952	10.3	8.6
1225.4	26	4	22	201	122	79	4919	4958	10.3	10.3
1226.5	26	4	22	201	122	79	4925	4965	10.3	12.0
1227.5	26	4	22	201	122	79	4931	4971	10.3	10.3
1228.5	26	4	22	201	122	79	4937	4977	10.3	10.3

TIME SEC.	R+ CNTS	R- CNTS	TOTAL R CNTS	B+ CNTS	B- CNTS	TOTAL B CNTS	ORF CNTS	OLR CNTS	SPEED-RF KM/HR.	SPEED- KM/HR
1229.5	26	4	22	201	122	79	4943	4983	10.3	10.
1230.5	26	4	22	201	122	79	4949	4990	10.3	12.0
1231.6	26	4	22	201	122	79	4956	4996	12.0	10.3
1232.6	26	4	22	201	122	79	4962	5002	10.3	10.3
1233.6	26	4	22	201	122	79	4967	5008	8.6	10.3
1234.6	26	4	22	201	122	79	4974	5014	12.0	10.3
1235.7	26	4	22	201	122	79	4979	5020	8.6	10.3
1236.7	26	4	22	201	122	79	4984	5026	8.6	10.3
1237.7	26	4	22	202	122	80	4989	5031	8.6	8.6
1238.7	26	4	22	202	122	80	4993	5035	6.8	6.8
1239.8	26	4	22	202	122	80	4999	5040	10.3	8.6
1240.8	26	4	22	202	122	80	5003	5045	6.8	8.6
1241.8	26	4	22	202	122	80	5008	5051	8.6	10.3
1242.8	26	4	22	202	122	80	5014	5056	10.3	8.6
1243.9	26	4	22	202	122	80	5019	5062	8.6	10.3
1244.9	26	4	22	202	122	80	5025	5067	10.3	8.6
1245.9	26	4	22	202	122	80	5032	5073	12.0	10.3
1246.9	26	4	22	202	122	80	5037	5079	8.6	10.3
1248.0	26	4	22	202	122	80	5044	5085	12.0	10.3
1249.0	26	4	22	202	122	80	5050	5091	10.3	10.3
1250.0	26	4	22	202	122	80	5056	5097	10.3	10.3
1251.0	26	4	22	202	122	80	5063	5103	12.0	10.3
1252.0	27	4	23	202	122	80	5069	5109	10.3	10.3
1253.1	27	4	23	202	122	80	5075	5115	10.3	10.3
1254.1	27	4	23	202	122	80	5080	5121	8.6	10.3
1255.1	27	4	23	202	122	80	5086	5127	10.3	10.3
1256.1	27	4	23	202	122	80	5092	5132	10.3	8.6
1257.2	27	4	23	202	123	79	5098	5138	10.3	10.3
1258.2	27	4	23	202	123	79	5104	5144	10.3	10.3
1259.2	27	4	23	202	123	79	5110	5150	10.3	10.3
1260.2	27	4	23	202	123	79	5117	5156	12.0	10.3
1261.3	27	4	23	202	123	79	5122	5163	8.6	12.0
1262.3	27	4	23	202	123	79	5128	5169	10.3	10.3
1263.3	27	4	23	202	123	79	5134	5175	10.3	10.3
1264.3	27	4	23	202	123	79	5141	5182	12.0	12.0
1265.4	27	4	23	202	123	79	5147	5189	10.3	12.0
1266.4	27	4	23	202	123	79	5153	5196	10.3	12.0
1267.4	27	4	23	202	123	79	5159	5203	10.3	12.0
1268.4	27	4	23	202	123	79	5162	5208	5.1	8.6
1269.5	27	4	23	202	123	79	5166	5212	6.8	6.8
1270.5	27	4	23	202	123	79	5170	5215	6.8	5.1
1271.5	27	4	23	202	123	79	5173	5219	5.1	6.8
1272.5	27	4	23	202	123	79	5177	5223	6.8	6.8
1273.5	27	4	23	202	123	79	5181	5227	6.8	6.8
1274.6	27	4	23	202	123	79	5186	5232	8.6	8.6
1275.6	27	4	23	202	123	79	5191	5237	8.6	8.6
1276.6	27	4	23	202	123	79	5197	5243	10.3	10.3
1277.6	27	4	23	202	123	79	5202	5248	8.6	8.6
1278.7	27	4	23	202	123	79	5208	5254	10.3	10.3
1279.7	27	4	23	203	123	80	5214	5260	10.3	10.3
1280.7	27	4	23	203	123	80	5222	5267	13.7	12.0
1281.7	27	4	23	203	123	80	5228	5274	10.3	12.0
1282.8	27	4	23	203	123	80	5234	5280	10.3	10.3
1283.8	27	4	23	203	123	80	5240	5286	10.3	10.3
1284.8	27	4	23	203	123	80	5246	5292	10.3	10.3
1285.8	27	4	23	203	123	80	5252	5298	10.3	10.3
1286.9	27	4	23	203	123	80	5258	5303	10.3	8.6
1287.9	27	4	23	203	123	80	5264	5309	10.3	10.3
1288.9	27	4	23	203	123	80	5271	5315	12.0	10.3
1289.9	27	4	23	203	123	80	5276	5321	8.6	10.3

TIME SEC.	CNTS	R- CNTS	TOTAL R CNTS	B+ CNTS	B- CNTS	TOTAL B CNTS	ORF CNTS	OLR CNTS	SPEED-RF KM/HR.	SPEED-L KM/HR.
1290.9	27	4	23	203	123	80	5282	5326	10.3	8.6
1292.0	27	4	23	203	123	80	5287	5330	8.6	6.8
1293.0	27	4	23	203	123	80	5292	5335	6.6	8.6
1294.0	27	4	23	203	123	80	5297	5340	8.6	8.6
1295.0	27	4	23	203	123	80	5302	5345	8.6	8.6
1296.1	28	4	24	203	123	80	5306	5349	6.8	6.8
1297.1	28	4	24	203	123	80	5311	5354	8.6	8.6
1298.1	28	4	24	203	123	80	5316	5359	8.6	8.6
1299.1	28	4	24	203	123	80	5320	5363	6.8	6.8
1300.2	28	4	24	203	123	80	5325	5368	8.6	8.6
1301.2	28	4	24	203	123	80	5330	5373	8.6	8.6
1302.2	28	4	24	203	123	80	5335	5378	8.6	8.6
1303.2	28	4	24	203	123	80	5340	5383	8.6	8.6
1304.3	28	4	24	203	123	80	5346	5389	10.3	10.3
1305.3	28	4	24	203	123	80	5351	5394	8.6	8.6
1306.3	28	4	24	203	123	80	5357	5400	10.3	10.3
1307.3	28	4	24	203	123	80	5362	5406	8.6	10.3
1308.4	28	4	24	203	123	80	5369	5412	12.0	10.3
1309.4	28	4	24	203	123	80	5375	5418	10.3	10.3
1310.4	28	4	24	203	123	80	5381	5425	10.3	12.0
1311.4	28	4	24	203	123	80	5388	5432	12.0	12.0
1312.4	28	4	24	203	123	80	5394	5439	10.3	12.0
1313.5	28	4	24	203	123	80	5401	5446	12.0	12.0
1314.5	28	4	24	203	123	80	5408	5453	12.0	12.0
1315.5	28	4	24	203	123	80	5414	5460	10.3	12.0
1316.5	28	4	24	203	123	80	5421	5466	12.0	10.3
1317.6	28	4	24	203	123	80	5427	5473	10.3	12.0
1318.6	28	4	24	203	123	80	5433	5479	10.3	10.3
1319.6	28	4	24	203	123	80	5438	5484	8.6	8.6
1320.6	28	4	24	203	123	80	5441	5489	5.1	8.6
1321.7	28	4	24	203	123	80	5445	5493	6.8	6.8
1322.7	28	4	24	203	123	80	5449	5498	6.8	8.6
1323.7	28	4	24	203	123	80	5454	5502	8.5	6.8
1324.7	28	4	24	203	123	80	5459	5506	8.6	6.8
1325.8	28	4	24	203	123	80	5463	5511	6.8	8.6
1326.8	28	4	24	203	123	80	5468	5516	8.6	8.6
1327.8	28	4	24	203	123	80	5473	5522	8.6	10.3
1328.8	28	4	24	203	123	80	5479	5527	10.3	8.6
1329.9	28	4	24	203	123	80	5485	5533	10.3	10.3
1330.9	28	4	24	203	123	80	5491	5540	10.3	12.0
1331.9	28	4	24	203	123	80	5495	5544	6.8	6.8
1332.9	28	4	24	203	123	80	5499	5547	6.8	5.1
1333.9	28	4	24	203	123	80	5504	5552	8.6	8.6
1335.0	28	4	24	203	123	80	5508	5555	6.8	5.1
1336.0	28	4	24	203	123	80	5512	5559	6.8	6.8
1337.0	28	4	24	203	123	80	5515	5562	5.1	5.1
1338.0	28	4	24	203	123	80	5518	5565	5.1	5.1
1339.1	29	4	25	203	123	80	5522	5569	6.8	6.8
1340.1	29	4	25	203	123	80	5525	5573	5.1	6.8
1341.1	29	4	25	203	123	80	5530	5577	8.6	6.8
1342.1	29	4	25	203	123	80	5536	5582	10.3	8.6
1343.2	29	4	25	203	123	80	5541	5586	8.6	6.8
1344.2	29	4	25	203	123	80	5545	5591	6.8	8.6
1345.2	29	4	25	203	123	80	5550	5595	8.6	6.8
1346.2	29	4	25	203	123	80	5554	5601	6.8	10.3
1347.3	29	4	25	203	123	80	5559	5606	8.6	8.6
1348.3	29	4	25	203	123	80	5564	5611	8.6	8.6
1349.3	29	4	25	203	123	80	5569	5616	8.6	8.6
1350.3	29	4	25	203	123	80	5574	5622	8.6	10.3
1351.4	29	4	25	203	123	80	5580	5628	10.3	10.3

TIME SEC.	R+ CNTS	R- CNTS	TOTAL R CNTS	B+ CNTS	B- CNTS	TOTAL B CNTS	OBF CNTS	OLR CNTS	SPEED-RF LM/LR.	SPEED-LF LM/LR.
1352.4	29	4	25	203	123	80	5586	5635	10.3	12.0
1353.4	29	4	25	203	123	80	5593	5641	12.0	10.3
1354.4	29	4	25	203	123	80	5599	5648	10.3	12.0
1355.4	29	4	25	203	123	80	5606	5655	12.0	12.0
1356.5	29	4	25	203	123	80	5613	5662	12.0	12.0
1357.5	29	4	25	203	123	80	5619	5669	10.3	12.0
1358.5	29	4	25	203	123	80	5626	5676	12.0	12.0
1359.5	29	4	25	203	123	80	5633	5683	12.0	12.0
1360.6	29	4	25	203	123	80	5640	5690	12.0	12.0
1361.6	29	4	25	203	123	80	5646	5696	10.3	10.3
1362.6	29	4	25	203	123	80	5653	5703	12.0	12.0
1363.6	29	4	25	203	123	80	5660	5710	12.0	12.0
1364.7	29	4	25	203	123	80	5666	5717	10.3	12.0
1365.7	29	4	25	203	123	80	5673	5723	12.0	10.3
1366.7	29	4	25	203	123	80	5679	5730	10.3	12.0
1367.7	29	4	25	203	123	80	5685	5736	10.3	10.3
1368.8	29	4	25	203	123	80	5692	5743	12.0	12.0
1369.8	29	4	25	203	123	80	5698	5749	10.3	10.3
1370.8	29	4	25	203	123	80	5703	5755	8.6	10.3
1371.8	29	4	25	203	123	80	5710	5761	12.0	10.3
1372.8	29	4	25	203	123	80	5716	5767	10.3	10.3
1373.9	29	4	25	203	123	80	5722	5774	10.3	12.0
1374.9	29	4	25	203	123	80	5728	5780	10.3	10.3
1375.9	29	4	25	203	123	80	5734	5786	10.3	10.3
1376.9	30	4	26	203	123	80	5740	5792	10.3	10.3
1378.0	30	4	26	204	123	81	5746	5797	10.3	8.6
1379.0	30	4	26	204	124	80	5751	5803	8.6	10.3
1380.0	30	4	26	204	124	80	5756	5809	8.6	8.6
1381.0	30	4	26	204	124	80	5762	5814	10.3	10.3
1382.1	30	4	26	205	124	81	5767	5819	8.6	8.6
1383.1	30	4	26	205	124	81	5773	5825	10.3	10.3
1384.1	30	4	26	205	124	81	5778	5831	8.6	10.3
1385.1	30	4	26	205	124	81	5783	5836	8.6	8.6
1386.2	30	4	26	205	124	81	5789	5842	10.3	10.3
1387.2	30	4	26	205	124	81	5795	5848	10.3	10.3
1388.2	30	4	26	205	124	81	5801	5854	10.3	10.3
1389.2	30	4	26	205	124	81	5806	5859	8.6	8.6
1390.3	30	4	26	205	124	81	5813	5865	12.0	10.3
1391.3	30	4	26	205	124	81	5817	5869	6.8	6.8
1392.3	30	4	26	205	124	81	5821	5874	6.8	8.6
1393.3	30	4	26	205	124	81	5825	5879	6.8	8.6
1394.3	30	4	26	205	124	81	5830	5884	8.6	8.6
1395.4	30	4	26	205	124	81	5835	5889	8.6	8.6
1396.4	30	4	26	205	124	81	5841	5895	10.3	10.3
1397.4	30	4	26	205	124	81	5846	5901	8.6	10.3
1398.4	30	4	26	205	124	81	5852	5907	10.3	10.3
1399.5	30	4	26	205	124	81	5857	5913	8.6	10.3
1400.5	30	4	26	205	124	81	5863	5920	10.3	12.0
1401.5	30	4	26	205	124	81	5868	5925	8.6	8.6
1402.5	30	4	26	205	124	81	5874	5931	10.3	10.3
1403.6	30	4	26	205	124	81	5880	5936	10.3	8.6
1404.6	30	4	26	205	124	81	5886	5942	10.3	10.3
1405.6	30	4	26	205	124	81	5892	5948	10.3	10.3
1406.6	30	4	26	205	124	81	5897	5954	6.6	10.3
1407.7	30	4	26	205	124	81	5902	5960	8.6	10.3
1408.7	30	4	26	205	124	81	5908	5965	10.3	8.6
1409.7	30	4	26	205	124	81	5913	5970	8.6	8.6
1410.7	30	4	26	205	124	81	5918	5975	8.6	8.6
1411.8	30	4	26	205	124	81	5924	5980	10.3	8.6
1412.8	30	4	26	205	124	81	5929	5985	8.6	8.6

TIME SEC.	R+ CNTS	R- CNTS	TOTAL R CNTS	B+ CNTS	B- CNTS	TOTAL B CNTS	ORF CNTS	OLR CNTS	SPEED-RF KM/HR.	SPEED-LR KM/HR.
1413.8	30	4	26	205	124	81	5934	5990	8.6	8.6
1414.8	30	4	26	205	124	81	5938	5995	6.8	8.6
1415.8	30	4	26	205	124	81	5943	6000	8.6	8.6
1416.9	30	4	26	206	124	82	5947	6004	6.8	6.8
1417.9	30	4	26	206	124	82	5952	6009	8.6	8.6
1418.9	30	4	26	206	124	82	5956	6013	6.8	6.8
1419.9	30	4	26	206	124	82	5959	6016	5.1	5.1
1421.0	30	4	26	206	124	82	5962	6018	5.1	3.4
1422.0	30	4	26	206	124	82	5964	6020	3.4	3.4
1423.0	30	4	26	206	124	82	5966	6022	3.4	3.4
1424.0	30	4	26	206	124	82	5967	6023	1.7	1.7
1425.1	30	4	26	206	124	82	5968	6024	1.7	1.7
1426.1	30	4	26	206	124	82	5970	6026	3.4	3.4
1427.1	30	4	26	206	124	82	5972	6028	3.4	3.4
1428.1	30	4	26	206	124	82	5974	6030	3.4	3.4
1429.2	30	4	26	206	124	82	5976	6033	3.4	3.4
1430.2	30	4	26	206	124	82	5978	6035	3.4	3.4
1431.2	30	4	26	206	124	82	5980	6037	3.4	3.4
1432.2	30	4	26	206	124	82	5982	6039	3.4	3.4
1433.3	30	4	26	206	124	82	5983	6041	1.7	3.4
1434.3	30	4	26	206	124	82	5985	6043	3.4	3.4
1435.3	30	4	26	206	124	82	5986	6044	1.7	1.7
1436.3	30	4	26	206	124	82	5986	6044	.0	.0
1437.3	30	4	26	206	124	82	5986	6044	.0	.0
1438.4	30	4	26	206	124	82	5986	6044	.0	.0
1439.4	30	4	26	206	124	82	5986	6044	.0	.0
1440.4	30	4	26	206	124	82	5986	6044	.0	.0
1441.4	30	4	26	206	124	82	5986	6044	.0	.0
1442.5	30	4	26	206	124	82	5986	6044	.0	.0
1443.5	30	4	26	206	124	82	5986	6044	.0	.0
1444.5	30	4	26	206	124	82	5986	6044	.0	.0
1445.5	30	4	26	206	124	82	5986	6044	.0	.0
1446.6	30	4	26	206	124	82	5986	6044	.0	.0
1447.6	30	4	26	206	124	82	5986	6044	.0	.0
1448.6	30	4	26	206	124	82	5986	6044	.0	.0
1449.6	30	4	26	206	124	82	5986	6044	.0	.0
1450.7	30	4	26	206	124	82	5986	6044	.0	.0
1451.7	30	4	26	206	124	82	5986	6044	.0	.0
1452.7	30	4	26	206	124	82	5986	6044	.0	.0
1453.7	30	4	26	206	124	82	5986	6044	.0	.0
1454.7	30	4	26	206	124	82	5986	6044	.0	.0
1455.8	30	4	26	206	124	82	5986	6044	.0	.0
1456.8	30	4	26	206	124	82	5986	6044	.0	.0
1457.8	30	4	26	206	124	82	5986	6044	.0	.0
1458.8	30	4	26	206	124	82	5986	6044	.0	LRV-1 .0
1459.9	30	4	26	206	124	82	5986	6044	.0	.0
1460.9	30	4	26	206	124	82	5986	6044	.0	.0
1461.9	30	4	26	206	124	82	5986	6044	.0	.0
1462.9	30	4	26	206	124	82	5986	6044	.0	.0
1464.0	30	4	26	206	124	82	5986	6044	.0	.0
1465.0	30	4	26	206	124	82	5986	6044	.0	.0
1466.0	30	4	26	206	124	82	5986	6044	.0	.0
1467.0	30	4	26	206	124	82	5986	6044	.0	.0
1468.1	30	4	26	206	124	82	5986	6044	.0	.0
1469.1	30	4	26	206	124	82	5986	6044	.0	.0
1470.1	30	4	26	206	124	82	5986	6044	.0	.0
1471.1	30	4	26	206	124	82	5986	6044	.0	.0
1472.2	30	4	26	206	124	82	5986	6044	.0	.0
1473.2	30	4	26	206	124	82	5986	6044	.0	.0
1474.2	30	4	26	206	124	82	5986	6044	.0	.0

TIME SEC.	R+ CNTS	R- CNTS	TOTAL R CNTS	L+ CNTS	L- CNTS	TOTAL L CNTS	ORF CNTS	OLR CNTS	SPEED-RF KM/HR.	SPEED-LR KM/HR.
1475.2	30	4	26	206	124	82	5986	6044	.0	.0
1476.2	30	4	26	206	124	82	5986	6044	.0	.0
1477.3	30	4	26	206	124	82	5986	6044	.0	.0
1478.3	30	4	26	206	124	82	5986	6044	.0	.0
1479.3	30	4	26	206	124	82	5986	6044	.0	.0
1480.3	30	4	26	206	124	82	5986	6044	.0	.0
1481.4	30	4	26	206	124	82	5986	6044	.0	.0
1482.4	30	4	26	206	124	82	5986	6044	.0	.0
1483.4	30	4	26	206	124	82	5986	6044	.0	.0
1484.4	30	4	26	206	124	82	5986	6044	.0	.0
1485.5	30	4	26	206	124	82	5986	6044	.0	.0
1486.5	30	4	26	206	124	82	5986	6044	.0	.0
1487.5	30	4	26	206	124	82	5986	6044	.0	.0
1488.5	30	4	26	206	124	82	5986	6044	.0	.0
1489.6	30	4	26	206	124	82	5986	6044	.0	.0
1490.6	30	4	26	206	124	82	5986	6044	.0	.0
1491.6	30	4	26	206	124	82	5986	6044	.0	.0
1492.6	30	4	26	206	124	82	5986	6044	.0	.0
1493.7	30	4	26	206	124	82	5986	6044	.0	.0
1494.7	30	4	26	206	124	82	5986	6044	.0	.0
1495.7	30	4	26	206	124	82	5986	6044	.0	.0
1496.7	30	4	26	206	124	82	5986	6044	.0	.0
1497.7	30	4	26	206	124	82	5986	6044	.0	.0
1498.8	30	4	26	206	124	82	5986	6044	.0	.0
1499.8	30	4	26	206	124	82	5986	6044	.0	.0
1500.8	30	4	26	206	124	82	5986	6044	.0	.0
1501.8	30	4	26	206	124	82	5986	6044	.0	.0
1502.9	30	4	26	206	124	82	5986	6044	.0	.0
1503.9	30	4	26	206	124	82	5986	6044	.0	.0
1504.9	30	4	26	206	124	82	5986	6044	.0	.0
1505.9	30	4	26	206	124	82	5986	6044	.0	.0
1507.0	30	4	26	206	124	82	5986	6044	.0	.0
1508.0	30	4	26	206	124	82	5986	6044	.0	.0
1509.0	30	4	26	206	124	82	5986	6044	.0	.0
1510.0	30	4	26	206	124	82	5986	6044	.0	.0
1511.1	30	4	26	206	124	82	5986	6044	.0	.0
1512.1	30	4	26	206	124	82	5986	6044	.0	.0
1513.1	30	4	26	206	124	82	5986	6044	.0	.0
1514.1	30	4	26	206	124	82	5986	6044	.0	.0
1515.2	30	4	26	206	124	82	5986	6044	.0	.0
1516.2	30	4	26	206	124	82	5986	6044	.0	.0
1517.2	30	4	26	206	124	82	5986	6044	.0	.0
1518.2	30	4	26	206	124	82	5986	6044	.0	.0
1519.2	30	4	26	206	124	82	5986	6044	.0	.0
1520.3	30	4	26	206	124	82	5986	6044	.0	.0
1521.3	30	4	26	206	124	82	5986	6044	.0	.0
1522.3	30	4	26	206	124	82	5986	6044	.0	.0
1523.3	30	4	26	206	124	82	5986	6044	.0	.0
1524.4	30	4	26	206	124	82	5986	6044	.0	.0
1525.4	30	4	26	206	124	82	5986	6044	.0	.0
1526.4	30	4	26	206	124	82	5986	6044	.0	.0
1527.4	30	4	26	206	124	82	5986	6044	.0	.0
1528.5	30	4	26	206	124	82	5986	6044	.0	.0
1529.5	30	4	26	206	124	82	5986	6044	.0	.0
1530.5	30	4	26	206	124	82	5986	6044	.0	.0
1531.5	30	4	26	206	124	82	5986	6044	.0	.0
1532.6	30	4	26	206	124	82	5987	6045	1.7	1.7
1533.6	30	4	26	206	124	82	5988	6045	1.7	.0
1534.6	30	4	26	206	124	82	5989	6046	1.7	1.7
1535.6	30	4	26	206	125	81	5990	6047	1.7	1.7

TIME SEC.	R+ CNTS	R- CNTS	TOTAL R CNTS	B+ CNTS	B- CNTS	TOTAL B CNTS	ORF CNTS	OLR CNTS	SPEED-RF KM/HR.	SPEED-LR KM/HR.
1536.6	31	4	27	206	125	81	5991	6048	1.7	1.7
1537.7	31	4	27	206	125	81	5993	6050	3.4	3.4
1538.7	31	5	26	207	125	82	5996	6053	5.1	5.1
1539.7	31	5	26	207	125	82	5999	6056	5.1	5.1
1540.7	32	5	27	207	125	82	6003	6059	6.8	5.1
1541.8	32	5	27	207	125	82	6007	6063	6.8	6.8
1542.8	32	5	27	207	125	82	6011	6067	6.8	6.8
1543.8	32	5	27	207	125	82	6015	6070	6.8	5.1
1544.8	32	5	27	207	125	82	6019	6073	6.8	5.1
1545.9	32	5	27	207	125	82	6026	6079	12.0	10.3
1546.9	32	5	27	207	125	82	6031	6083	8.6	6.8
1547.9	32	5	27	207	125	82	6035	6088	8.8	8.6
1548.9	32	5	27	207	125	82	6040	6092	8.6	8.6
1550.0	32	5	27	207	125	82	6045	6097	8.6	8.6
1551.0	32	5	27	207	125	82	6049	6102	6.8	8.6
1552.0	32	5	27	207	125	82	6055	6107	10.3	8.6
1553.0	32	5	27	207	125	82	6060	6112	8.6	8.6
1554.1	32	5	27	207	125	82	6065	6118	8.6	10.3
1555.1	32	5	27	207	125	82	6071	6123	10.3	8.6
1556.1	32	5	27	207	125	82	6076	6129	8.6	10.3
1557.1	32	5	27	207	125	82	6082	6134	10.3	8.6
1558.1	32	5	27	207	125	82	6087	6140	8.6	10.3
1559.2	32	5	27	20	125	82	6093	6146	10.3	10.3.
1560.2	32	5	27	207	125	82	6099	6151	10.3	8.6
1561.2	32	5	27	207	125	82	6104	6157	8.6	10.3
1562.2	32	5	27	207	125	82	6110	6163	10.3	10.3
1563.3	32	5	27	207	125	82	6115	6168	8.6	8.6
1564.3	32	5	27	207	125	82	6120	6174	8.6	10.3
1565.3	32	5	27	207	125	82	6126	6179	10.3	8.6
1566.3	32	5	27	207	125	82	6131	6185	8.6	10.3
1567.4	32	5	27	207	125	82	6137	6190	10.3	8.6
1568.4	32	5	27	207	125	82	6143	6197	10.3	12.0
1569.4	32	5	27	207	125	82	6148	6202	8.6	8.6
1570.4	32	5	27	207	125	82	6154	6207	10.3	8.6
1571.5	32	5	27	207	125	82	6159	6212	8.6	8.6
1572.5	32	5	27	207	125	82	6164	6216	8.6	6.8
1573.5	32	5	27	207	125	82	6170	6221	10.3	8.6
1574.5	32	5	27	207	125	82	6175	6226	8.6	8.6
1575.6	32	5	27	207	125	82	6180	6231	8.6	8.6
1576.6	32	5	27	207	126	81	6185	6236	8.6	8.6
1577.6	32	5	27	208	127	81	6190	6240	8.6	6.8
1578.6	32	5	27	208	127	81	6196	6245	10.3	8.6
1579.6	32	5	27	209	127	82	6201	6251	8.6	10.3
1580.7	32	5	27	210	128	82	6206	6256	8.6	8.6
1581.7	32	5	27	210	128	82	6212	6263	10.3	12.0
1582.7	32	5	27	210	128	82	6217	6269	8.6	10.3
1583.7	32	5	27	210	128	82	6223	6275	10.3	10.3
1584.8	32	5	27	210	128	82	6229	6282	10.3	12.0
1585.8	33	5	28	210	128	82	6236	6289	12.0	12.0
1586.8	33	5	28	210	128	82	6243	6295	12.0	10.3
1587.8	33	5	28	210	128	82	6250	6302	12.0	12.0
1588.9	33	5	28	210	128	82	6255	6308	8.6	10.3
1589.9	33	5	28	210	128	82	6261	6315	10.3	12.0
1590.9	33	5	28	210	128	82	6267	6321	10.3	10.3
1591.9	33	5	28	210	128	82	6273	6327	10.3	10.3
1593.0	33	5	28	210	128	82	6280	6334	12.0	12.0
1594.0	33	5	28	210	128	82	6287	6341	12.0	12.0
1595.0	33	5	28	210	128	82	6293	6347	10.3	10.3
1596.0	33	5	28	210	128	82	6300	6355	12.0	13.7
1597.1	33	5	28	210	128	82	6307	6361	12.0	10.3

TIME SEC.	R+ CNTS	R- CNTS	TOTAL R CNTS	L+ CNTS	L- CNTS	TOTAL L CNTS	ORF CNTS	OLR CNTS	SPEED-RF KM/HR.	SPEED-LF KM/HR.
1598.1	33	5	28	210	128	82	6314	6368	12.0	12.0
1599.1	33	5	28	210	128	82	6320	6374	10.3	10.3
1600.1	33	5	28	210	128	82	6327	6380	12.0	10.3
1601.1	33	5	28	210	128	82	6333	6386	10.3	10.3
1602.2	33	5	28	210	128	82	6340	6391	12.0	8.6
1603.2	33	5	28	210	128	82	6346	6397	10.3	10.3
1604.2	33	5	28	210	128	82	6352	6404	10.3	12.0
1605.2	33	5	28	210	128	82	6358	6410	10.3	10.3
1606.3	33	5	28	210	128	82	6364	6415	10.3	8.6
1607.3	33	5	28	210	128	82	6369	6421	8.6	10.3
1608.3	33	5	28	210	128	82	6375	6427	10.3	10.3
1609.3	33	5	28	210	128	82	6382	6433	12.0	10.3
1610.4	33	5	28	210	128	82	6387	6439	8.6	10.3
1611.4	33	5	28	210	128	82	6393	6446	10.3	12.0
1612.4	33	5	28	210	128	82	6399	6452	10.3	10.3
1613.4	33	5	28	210	128	82	6404	6458	8.6	10.3
1614.5	33	5	28	210	128	82	6409	6463	8.6	8.6
1615.5	33	5	28	210	128	82	6415	6469	10.3	10.3
1616.5	33	5	28	210	128	82	6421	6475	10.3	12.0
1617.5	33	5	28	210	128	82	6426	6481	8.6	8.6
1618.5	33	5	28	210	128	82	6431	6486	8.6	8.6
1619.6	33	5	28	210	128	82	6436	6491	8.6	8.6
1620.6	33	5	28	210	128	82	6440	6495	6.8	6.8
1621.6	33	5	28	210	128	82	6445	6500	8.6	8.6
1622.6	33	5	28	210	128	82	6449	6505	6.8	8.6
1623.7	34	5	29	210	128	82	6454	6510	8.6	8.6
1624.7	34	5	29	210	128	82	6459	6514	8.6	6.8
1625.7	34	5	29	210	129	81	6464	6519	8.6	8.6
1626.7	34	5	29	210	129	81	6469	6524	8.6	8.6
1627.8	34	5	29	210	129	81	6474	6528	8.6	6.8
1628.8	34	5	29	210	129	81	6479	6533	8.6	8.6
1629.8	34	5	29	210	129	81	6483	6537	6.8	6.8
1630.8	34	5	29	211	129	82	6487	6541	6.8	6.8
1631.9	34	5	29	211	129	82	6490	6545	5.1	6.8
1632.9	34	5	29	211	129	82	6493	6549	5.1	6.8
1633.9	34	5	29	211	129	82	6496	6552	5.1	5.1
1634.9	34	5	29	211	129	82	6499	6556	5.1	6.8
1636.0	34	5	29	211	129	82	6502	6559	5.1	5.1
1637.0	34	5	29	211	130	81	6505	6563	5.1	6.8
1638.0	34	5	29	211	130	81	6509	6566	6.8	5.1
1639.0	34	5	29	211	130	81	6513	6570	6.8	6.8
1640.0	34	5	29	211	130	81	6517	6575	6.8	8.6
1641.1	34	5	29	211	130	81	6521	6579	6.8	6.8
1642.1	34	5	29	212	130	82	6525	6584	6.8	8.6
1643.1	34	5	29	212	130	82	6529	6588	6.8	6.8
1644.1	34	5	29	212	130	82	6531	6592	3.4	6.8
1645.2	34	5	29	212	130	82	6534	6595	5.1	5.1
1646.2	34	5	29	212	130	82	6538	6600	6.8	8.6
1647.2	34	5	29	212	130	82	6541	6604	5.1	6.8
1648.2	34	5	29	212	130	82	6546	6608	8.6	6.8
1649.3	34	5	29	212	130	82	6550	6612	6.8	6.8
1650.3	34	5	29	212	130	82	6555	6617	8.6	8.6
1651.3	34	5	29	212	130	82	6559	6621	6.8	6.8
1652.3	34	5	29	212	130	82	6564	6626	8.6	8.6
1653.4	34	5	29	212	130	82	6568	6630	6.8	6.8
1654.4	34	5	29	212	130	82	6573	6634	8.6	6.8
1655.4	34	5	29	212	130	82	6577	6638	6.8	6.8
1656.4	34	5	29	212	130	82	6580	6642	5.1	6.8
1657.5	34	5	29	212	130	82	6583	6645	5.1	5.1
1658.5	34	5	29	212	130	82	6586	6648	5.1	5.1

TIME SEC.	R+ CNTS	R- CNTS	TOTAL R CNTS	B+ CNTS	B- CNTS	TOTAL B CNTS	ORF CNTS	OLR CNTS	SPEED-RF KM/HR	SPEED-LR KM/HR
1659.5	34	5	29	212	130	82	6590	6652	6.8	6.8
1660.5	34	5	29	212	130	82	6594	6655	6.8	5.1
1661.5	34	5	29	213	130	83	6598	6658	6.8	5.1
1662.6	34	5	29	213	130	83	6604	6665	10.3	12.0
1663.6	34	5	29	213	130	83	6607	6669	5.1	6.8
1664.6	34	5	29	213	130	83	6611	6672	6.8	5.1
1665.6	34	5	29	213	130	83	6615	6676	6.8	6.8
1666.7	34	5	29	213	131	82	6619	6679	6.8	5.1
1667.7	34	5	29	214	131	83	6622	6683	5.1	6.8
1668.7	34	5	29	214	131	83	6626	6688	6.8	8.6
1669.7	34	5	29	214	132	82	6631	6694	8.6	10.3
1670.8	34	5	29	214	132	82	6636	6699	8.6	8.6
1671.8	34	5	29	214	132	82	6641	6705	8.6	10.3
1672.8	34	5	29	214	132	82	6646	6711	8.6	10.3
1673.8	34	5	29	214	132	82	6652	6717	10.3	10.3
1674.9	34	5	29	215	132	83	6657	6723	8.6	10.3
1675.9	34	5	29	215	132	83	6662	6728	8.6	8.6
1676.9	34	5	29	215	132	83	6667	6733	8.6	8.6
1677.9	34	5	29	215	132	83	6672	6739	8.6	10.3
1679.0	34	5	29	215	132	83	6678	6744	10.3	8.6
1680.0	34	5	29	215	132	83	6683	6750	8.6	10.3
1681.0	34	5	29	215	132	83	6689	6755	10.3	8.6
1682.0	34	5	29	215	132	83	6694	6761	8.6	10.3
1683.0	34	5	29	215	132	83	6700	6766	10.3	8.6
1684.1	34	5	29	215	132	83	6705	6772	8.6	10.3
1685.1	34	5	29	216	132	84	6711	6776	10.3	6.8
1686.1	34	5	29	216	132	84	6716	6781	8.6	8.6
1687.1	34	5	29	216	132	84	6722	6786	10.3	8.6
1688.2	34	5	29	216	132	84	6727	6792	8.6	10.3
1689.2	34	5	29	216	133	83	6734	6798	12.0	10.3
1690.2	34	5	29	216	133	83	6740	6803	10.3	8.6
1691.2	34	5	29	216	133	83	6745	6808	8.6	8.6
1692.3	34	5	29	216	133	83	6750	6813	8.6	8.6
1693.3	34	5	29	216	133	83	6755	6818	8.6	8.6
1694.3	34	5	29	216	133	83	6760	6823	8.6	8.6
1695.3	34	5	29	216	133	83	6766	6828	10.3	8.6
1696.4	34	5	29	216	133	83	6773	6833	12.0	8.6
1697.4	34	5	29	216	133	83	6778	6837	8.6	6.8
1698.4	34	5	29	216	133	83	6784	6842	10.3	8.6
1699.4	34	5	29	216	133	83	6790	6847	10.3	8.6
1700.4	34	5	29	216	133	83	6795	6853	8.6	10.3
1701.5	34	5	29	216	133	83	6802	6861	12.0	13.7
1702.5	34	5	29	216	133	83	6807	6867	8.6	10.3
1703.5	34	5	29	216	133	83	6812	6872	8.6	8.6
1704.5	34	5	29	216	133	83	6817	6877	8.6	8.6
1705.6	34	5	29	216	133	83	6822	6882	8.6	8.6
1706.6	34	5	29	216	133	83	6826	6886	6.8	6.8
1707.6	34	5	29	216	133	83	6830	6891	6.8	8.6
1708.6	35	5	30	216	133	83	6835	6895	8.6	6.8
1709.7	35	5	30	216	133	83	6840	6900	8.6	8.6
1710.7	35	5	30	216	133	83	6844	6905	6.8	8.6
1711.7	35	5	30	217	133	84	6849	6910	8.6	8.6
1712.7	35	5	30	217	133	84	6854	6915	8.6	8.6
1713.8	35	5	30	217	133	84	6859	6921	8.6	10.3
1714.8	35	5	30	217	133	84	6865	6927	10.3	10.3
1715.8	35	5	30	217	133	84	6870	6932	8.6	8.6
1716.8	35	5	30	218	134	84	6876	6938	10.3	10.3
1717.9	35	5	30	218	135	83	6882	6945	10.3	12.0
1718.9	35	5	30	219	135	84	6888	6950	10.3	8.6
1719.9	35	5	30	219	136	83	6893	6955	8.6	8.6

TIME SEC.	R+ CNTS	R- CNTS	TOTAL R CNTS	L+ CNTS	L- CNTS	TOTAL L CNTS	ORF CNTS	OLR CNTS	SPEED-RF KM/HR.	SPEED-LF KM/HR.
1720.9	35	5	30	219	136	83	6899	6960	10.3	8.6
1721.9	35	5	30	219	136	83	6904	6965	8.6	8.6
1723.0	35	5	30	219	136	83	6910	6971	10.3	10.3
1724.0	35	5	30	219	136	83	6915	6977	8.6	10.3
1725.0	35	5	30	219	136	83	6921	6983	10.3	10.3
1726.0	35	5	30	219	136	83	6927	6989	10.3	10.3
1727.1	35	5	30	219	136	83	6933	6996	10.3	12.0
1728.1	35	5	30	219	136	83	6938	7002	8.6	10.3
1729.1	35	5	30	219	136	83	6944	7007	10.3	8.6
1730.1	35	5	30	219	136	83	6950	7012	10.3	8.6
1731.2	35	5	30	219	136	83	6955	7018	8.6	10.3
1732.2	35	5	30	219	136	83	6960	7023	8.6	8.6
1733.2	35	5	30	219	136	83	6965	7029	8.6	10.3
1734.2	35	5	30	219	136	83	6971	7035	10.3	10.3
1735.3	35	5	30	219	136	83	6977	7041	10.3	10.3
1736.3	35	5	30	219	136	83	6983	7047	10.3	10.3
1737.3	35	5	30	219	136	83	6989	7054	10.3	12.0
1738.3	35	5	30	219	136	83	6995	7060	10.3	10.3
1739.4	35	5	30	219	136	83	7002	7066	12.0	10.3
1740.4	35	5	30	219	136	83	7008	7072	10.3	10.3
1741.4	35	5	30	219	136	83	7013	7078	8.6	10.3
1742.4	35	5	30	219	136	83	7019	7085	10.3	12.0
1743.4	35	5	30	219	136	83	7025	7090	10.3	8.6
1744.5	35	5	30	219	136	83	7031	7097	10.3	12.0
1745.5	35	5	30	219	136	83	7037	7103	10.3	10.3
1746.5	35	5	30	219	136	83	7043	7109	10.3	10.3
1747.5	36	5	31	219	136	83	7049	7116	10.3	12.0
1748.6	36	5	31	219	136	83	7055	7121	10.3	8.6
1749.6	36	5	31	219	136	83	7061	7126	10.3	8.6
1750.6	36	5	31	219	136	83	7067	7131	10.3	8.6
1751.6	36	5	31	219	136	83	7073	7137	10.3	10.3
1752.7	36	5	31	219	136	83	7077	7142	8.6	8.6
1753.7	36	5	31	219	136	83	7081	7147	8.6	8.6
1754.7	36	5	31	219	136	83	7085	7152	8.6	8.6
1755.7	36	5	31	219	136	83	7090	7157	8.6	8.6
1756.8	36	5	31	219	136	83	7095	7162	8.6	8.6
1757.8	36	5	31	220	136	84	7100	7168	8.6	10.3
1758.8	36	5	31	220	136	84	7106	7173	10.3	8.6
1759.8	36	5	31	220	136	84	7111	7177	8.6	8.6
1760.9	36	5	31	220	136	84	7117	7183	10.3	10.3
1761.9	36	5	31	220	137	83	7122	7188	8.6	8.6
1762.9	36	5	31	220	137	83	7127	7193	8.6	8.6
1763.9	36	5	31	220	137	83	7131	7198	8.8	8.6
1764.9	36	5	31	220	137	83	7136	7202	8.6	8.8
1766.0	36	5	31	220	137	83	7141	7208	8.6	10.3
1767.0	36	5	31	220	137	83	7145	7213	8.8	8.6
1768.0	36	5	31	220	137	83	7149	7217	8.8	8.8
1769.0	36	5	31	220	137	83	7153	7221	8.8	8.8
1770.1	36	5	31	220	137	83	7158	7226	8.6	8.6
1771.1	36	5	31	220	137	83	7162	7230	8.8	8.8
1772.1	36	5	31	220	137	83	7167	7235	8.6	8.6
1773.1	36	5	31	220	137	83	7173	7239	10.3	8.8
1774.2	36	5	31	220	137	83	7177	7245	8.8	10.3
1775.2	36	5	31	220	137	83	7183	7249	10.3	8.8
1776.2	36	5	31	220	137	83	7188	7254	8.6	8.6
1777.2	36	5	31	220	137	83	7193	7259	8.6	8.6
1778.3	36	5	31	220	137	83	7199	7265	10.3	10.3
1779.3	36	5	31	220	137	83	7204	7270	8.6	8.6
1780.3	36	5	31	220	137	83	7211	7277	12.0	12.0
1781.3	36	5	31	220	137	83	7216	7282	8.6	8.6

TIME SEC.	R+ CNTS	R- CNTS	TOTAL R CNTS	L+ CNTS	L- CNTS	TOTAL L CNTS	ORF CNTS	OLR CNTS	SPEED-RF KM/HR.	SPEED-LR KM/HR.
1782.3	36	5	31	220	137	83	7222	7288	10.3	10.3
1783.4	36	5	31	220	137	83	7228	7294	10.3	10.3
1784.4	36	5	31	220	137	83	7234	7300	10.3	10.3
1785.4	36	5	31	220	137	83	7240	7307	10.3	12.0
1786.4	36	5	31	220	137	83	7246	7312	10.3	8.6
1787.5	36	5	31	220	137	83	7252	7317	10.3	8.6
1788.5	36	5	31	220	137	83	7257	7322	8.6	8.6
1789.5	36	5	31	220	137	83	7262	7327	8.6	8.6
1790.5	36	5	31	220	137	83	7267	7331	8.6	6.8
1791.6	36	5	31	220	137	83	7271	7336	6.8	8.6
1792.6	36	5	31	220	137	83	7276	7341	8.6	8.6
1793.6	37	5	32	220	137	83	7281	7346	8.6	8.6
1794.6	37	5	32	220	137	83	7286	7351	8.6	8.6
1795.7	37	5	32	220	137	83	7292	7357	10.3	10.3
1796.7	37	5	32	220	137	83	7298	7363	10.3	10.3
1797.7	37	5	32	220	137	83	7303	7369	8.6	10.3
1798.7	37	5	32	220	137	83	7309	7375	10.3	10.3
1799.8	37	5	32	220	137	83	7315	7382	10.3	12.0
1800.8	37	5	32	220	137	83	7321	7388	10.3	10.3
1801.8	37	5	32	220	137	83	7327	7395	10.3	12.0
1802.8	37	5	32	220	137	83	7333	7401	10.3	10.3
1803.8	37	5	32	220	137	83	7339	7407	10.3	10.3
1804.9	37	5	32	220	137	83	7346	7414	12.0	12.0
1805.9	37	5	32	220	137	83	7352	7420	10.3	10.3
1806.9	37	5	32	220	137	83	7358	7426	10.3	10.3
1807.9	37	5	32	220	137	83	7365	7432	12.0	10.3
1809.0	37	5	32	220	137	83	7371	7439	10.3	12.0
1810.0	37	5	32	220	[illegible]	83	7378	7445	12.0	10.3
1811.0	37	5	32	220	137	83	7384	7452	10.3	12.0
1812.0	37	5	32	220	137	83	7391	7459	12.0	12.0
1813.1	37	5	32	221	138	83	7398	7465	12.0	10.3
1814.1	37	5	32	222	138	84	7405	7473	12.0	13.7
1815.1	37	5	32	222	138	84	7412	7480	12.0	12.0
1816.1	37	5	32	222	138	84	7418	7486	10.3	10.3
1817.2	37	5	32	222	138	84	7425	7493	12.0	12.0
1818.2	37	5	32	222	138	84	7432	7500	12.0	12.0
1819.2	37	5	32	222	138	84	7439	7507	12.0	12.0
1820.2	37	5	32	222	138	84	7445	7515	10.3	13.7
1821.3	37	5	32	222	138	84	7452	7521	12.0	10.3
1822.3	37	5	32	222	138	84	7459	7528	12.0	12.0
1823.3	37	5	32	223	139	84	7465	7535	10.3	12.0
1824.3	37	5	32	223	139	84	7472	7542	12.0	12.0
1825.3	37	5	32	223	139	84	7480	7549	13.7	12.0
1826.4	37	5	32	224	140	84	7486	7557	10.3	13.7
1827.4	38	5	33	224	140	84	7494	7564	13.7	12.0
1828.4	38	5	33	224	140	84	7501	7571	12.0	12.0
1829.4	38	5	33	224	141	83	7508	7578	12.0	12.0
1830.5	38	5	33	224	141	83	7515	7584	12.0	10.3
1831.5	38	5	33	225	141	84	7522	7591	12.0	12.0
1832.5	38	5	33	225	142	83	7529	7598	12.0	12.0
1833.5	38	5	33	225	142	83	7536	7605	12.0	12.0
1834.6	38	5	33	225	142	83	7543	7612	12.0	12.0
1835.6	38	5	33	225	142	83	7550	7619	12.0	12.0
1836.6	38	5	33	225	142	83	7556	7626	10.3	12.0
1837.6	38	5	33	225	142	83	7563	7632	12.0	10.3
1838.7	38	5	33	225	142	83	7569	7639	10.3	12.0
1839.7	38	5	33	225	142	83	7576	7646	12.0	12.0
1840.7	38	5	33	225	142	83	7582	7653	10.3	12.0
1841.7	38	5	33	225	142	83	7588	7660	10.3	12.0
1842.8	38	5	33	225	142	83	7595	7666	12.0	10.3

DELTA T 1.0

TIME SEC.	R+ CNTS	R- CNTS	TOTAL R CNTS	B+ CNTS	B- CNTS	TOTAL B CNTS	ORF CNTS	OLR CNTS	SPEED-RF KM/HR.	SPEED-B KM/HR.
1843.8	38	5	33	225	142	83	7602	7673	12.0	12.0
1844.8	38	5	33	225	142	83	7608	7679	10.3	10.3
1845.8	38	5	33	225	142	83	7615	7686	12.0	12.0
1846.8	38	5	33	225	142	83	7621	7693	10.3	12.0
1847.9	38	5	33	225	142	83	7628	7699	12.0	10.3
1848.9	38	5	33	225	142	83	7635	7706	12.0	12.0
1849.9	38	5	33	225	142	83	7642	7713	12.0	12.0
1850.9	38	5	33	225	142	83	7648	7720	10.3	12.0
1852.0	38	5	33	225	142	83	7655	7727	12.0	12.0
1853.0	38	5	33	225	142	83	7662	7733	12.0	10.3
1854.0	38	5	33	225	142	83	7668	7740	10.3	12.0
1855.0	38	5	33	225	142	83	7674	7746	10.3	10.3
1856.1	38	5	33	225	142	83	7681	7753	12.0	12.0
1857.1	38	5	33	225	142	83	7688	7760	12.0	12.0
1858.1	38	5	33	225	142	83	7694	7767	10.3	12.0
1859.1	39	5	34	225	142	83	7701	7774	12.0	12.0
1860.2	39	5	34	225	142	83	7707	7781	10.3	12.0
1861.2	39	5	34	225	142	83	7714	7787	12.0	10.3
1862.2	39	5	34	225	142	83	7720	7794	10.3	12.0
1863.2	39	5	34	225	142	83	7727	7800	12.0	10.3
1864.2	39	5	34	225	142	83	7734	7807	12.0	12.0
1865.3	39	5	34	225	142	83	7740	7814	10.3	12.0
1866.3	39	5	34	225	142	83	7747	7821	12.0	12.0
1867.3	39	5	34	225	142	83	7754	7828	12.0	12.0
1868.3	39	5	34	225	142	83	7760	7835	10.3	12.0
1869.4	39	5	34	226	142	84	7767	7841	12.0	10.3
1870.4	39	5	34	226	142	84	7774	7848	12.0	12.0
1871.4	39	5	34	226	142	84	7780	7855	10.3	12.0
1872.4	39	5	34	226	142	84	7787	7861	12.0	10.3
1873.5	39	5	34	227	143	84	7794	7868	12.0	12.0
1874.5	39	5	34	227	144	83	7801	7874	12.0	10.3
1875.5	39	5	34	228	144	84	7809	7882	13.7	13.7
1876.5	39	5	34	228	144	84	7816	7889	12.0	12.0
1877.6	39	5	34	228	145	83	7823	7896	12.0	12.0
1878.6	39	5	34	229	145	84	7830	7903	12.0	12.0
1879.6	39	5	34	229	145	84	7837	7910	12.0	12.0
1880.6	39	5	34	229	145	84	7844	7917	12.0	12.0
1881.7	39	5	34	229	146	83	7851	7924	12.0	12.0
1882.7	39	5	34	230	146	84	7858	7931	12.0	12.0
1883.7	39	5	34	230	146	84	7864	7938	10.3	12.0
1884.7	39	5	34	230	146	84	7871	7945	12.0	12.0
1885.7	39	5	34	230	146	84	7877	7952	10.3	12.0
1886.8	39	5	34	230	146	84	7884	7958	12.0	10.3
1887.8	39	5	34	230	146	84	7890	7964	10.3	10.3
1888.8	39	5	34	230	146	84	7896	7969	10.3	8.6
1889.8	39	5	34	230	147	83	7903	7975	12.0	10.3
1890.9	39	5	34	230	147	83	7908	7980	8.6	8.6
1891.9	39	5	34	231	147	84	7914	7986	10.3	10.3
1892.9	39	5	34	231	147	84	7919	7991	8.6	8.6
1893.9	40	5	35	231	147	84	7925	7997	10.3	10.3
1895.0	40	5	35	231	148	83	7931	8003	10.3	10.3
1896.0	40	5	35	231	148	83	7937	8010	10.3	12.0
1897.0	40	5	35	231	148	83	7943	8016	10.3	10.3
1898.0	40	5	35	231	148	83	7949	8022	10.3	10.3
1899.1	40	5	35	231	148	83	7955	8029	10.3	12.0
1900.1	40	5	35	231	148	83	7961	8035	10.3	10.3
1901.1	40	5	35	231	148	83	7968	8042	12.0	12.0
1902.1	40	5	35	231	148	83	7975	8048	12.0	10.3
1903.2	40	5	35	231	148	83	7982	8055	12.0	12.0
1904.2	40	5	35	231	148	83	7988	8062	10.3	12.0

TIME SEC.	R+ CNTS	R- CNTS	TOTAL R CNTS	B+ CNTS	B- CNTS	TOTAL B CNTS	ORF CNTS	OLR CNTS	SPEED-RF KM/HR.	SPEED-LF KM/HR.
1905.2	40	5	35	231	148	83	7994	8069	10.3	12.0
1906.2	40	5	35	231	148	83	8000	8076	10.3	12.0
1907.2	40	5	35	231	148	83	8006	8082	10.3	10.3
1908.3	40	5	35	231	148	83	8013	8088	12.0	10.3
1909.3	40	5	35	231	148	83	8019	8094	10.3	10.3
1910.3	40	5	35	231	148	83	8025	8100	10.3	10.3
1911.3	40	5	35	231	148	83	8031	8107	10.3	12.0
1912.4	40	5	35	231	148	83	8035	8113	6.8	10.3
1913.4	40	5	35	231	148	83	8040	8117	8.6	6.8
1914.4	40	5	35	231	148	83	8046	8123	10.3	10.3
1915.4	40	5	35	231	148	83	8055	8131	15.5	13.7
1916.5	40	5	35	231	148	83	8057	8132	3.4	1.7
1917.5	40	5	35	231	148	83	8057	8133	.0	1.7
1918.5	40	5	35	231	148	83	8058	8134	1.7	1.7
1919.5	40	5	35	231	148	83	8058	8134	.0	.0
1920.6	40	5	35	231	148	83	8059	8135	1.7	1.7
1921.6	40	5	35	231	148	83	8060	8136	1.7	1.7
1922.6	40	5	35	231	148	83	8061	8137	1.7	1.7
1923.6	40	5	35	231	148	83	8063	8139	3.4	3.4
1924.7	40	5	35	231	148	83	8066	8141	5.1	3.4
1925.7	40	5	35	231	148	83	8070	8143	6.8	3.4
1926.7	40	5	35	231	148	83	8073	8144	5.1	1.7
1927.7	40	5	35	231	148	83	8075	8145	3.4	1.7
1928.7	40	5	35	231	148	83	8076	8146	1.7	1.7
1929.8	40	5	35	231	148	83	8078	8148	3.4	3.4
1930.8	40	5	35	231	148	83	8080	8150	3.4	3.4
1931.8	40	5	35	231	148	83	8082	8152	3.4	3.4
1932.8	40	5	35	231	148	83	8084	8155	3.4	5.1
1933.9	40	5	35	231	148	83	8087	8158	5.1	5.1
1934.9	40	5	35	231	148	83	8090	8161	5.1	5.1
1935.9	40	5	35	231	148	83	8094	8165	6.8	6.8
1936.9	40	5	35	231	148	83	8098	8169	6.8	6.8
1938.0	40	5	35	231	148	83	8103	8174	8.6	8.6
1939.0	40	5	35	231	148	83	8107	8178	6.8	6.8
1940.0	40	5	35	231	148	83	8111	8183	6.8	8.6
1941.0	40	5	35	231	148	83	8114	8187	5.1	6.8
1942.1	40	5	35	231	148	83	8117	8191	5.1	6.8
1943.1	40	5	35	231	148	83	8121	8194	6.8	5.1
1944.1	40	5	35	231	148	83	8124	8198	5.1	6.8
1945.1	40	5	35	231	148	83	8128	8203	6.8	8.6
1946.1	40	5	35	231	148	83	8132	8207	6.8	6.8
1947.2	40	5	35	231	148	83	8137	8212	8.6	8.6
1948.2	41	5	36	231	148	83	8142	8217	8.6	8.6
1949.2	41	5	36	231	148	83	8146	8222	6.8	8.6
1950.2	41	5	36	231	148	83	8151	8227	8.6	8.6
1951.3	41	5	36	231	148	83	8155	8232	6.8	8.6
1952.3	41	5	36	231	148	83	8160	8236	8.6	6.8
1953.3	41	5	36	231	148	83	8165	8240	8.6	8.6
1954.3	41	5	36	231	148	83	8170	8245	8.6	8.6
1955.4	41	5	36	231	148	83	8175	8249	8.6	6.8
1956.4	41	5	36	231	148	83	8180	8253	8.6	8.6
1957.4	41	5	36	231	148	83	8185	8258	8.6	8.6
1958.4	41	5	36	231	148	83	8190	8262	8.6	8.6
1959.5	41	5	36	231	148	83	8195	8267	8.6	8.6
1960.5	41	5	36	231	148	83	8200	8272	8.6	8.6
1961.5	41	5	36	231	148	83	8206	8278	10.3	10.3
1962.5	41	5	36	231	148	83	8212	8284	10.3	10.3
1963.6	41	5	36	231	148	83	8218	8290	10.3	10.3
1964.6	41	5	36	231	148	83	8225	8297	12.0	12.0
1965.6	41	5	36	231	148	83	8231	8303	10.3	10.3

TIME SEC.	R+ CNTS	R- CNTS	TOTAL R CNTS	B+ CNTS	B- CNTS	TOTAL B CNTS	ORF CNTS	OLR CNTS	SPEED-RF KM/HR.	SPEED-LR KM/HR.
1966.6	41	5	36	231	148	83	8237	8310	10.3	12.0
1967.6	41	5	36	231	148	83	8243	8316	10.3	10.3
1968.7	41	5	36	231	148	83	8249	8323	10.3	12.0
1969.7	41	5	36	231	148	83	8255	8330	10.3	12.0
1970.7	41	5	36	231	148	83	8261	8336	10.3	10.3
1971.7	41	5	36	231	148	83	8267	8342	10.3	10.3
1972.8	41	5	36	231	148	83	8273	8349	10.3	12.0
1973.8	41	5	36	231	148	83	8280	8355	12.0	10.3
1974.8	41	5	36	231	148	83	8286	8362	10.3	12.0
1975.8	41	5	36	231	148	83	8292	8368	10.3	10.3
1976.9	41	5	36	231	148	83	8299	8375	12.0	12.0
1977.9	41	5	36	231	148	83	8304	8381	8.6	10.3
1978.9	41	5	36	231	148	83	8311	8388	12.0	12.0
1979.9	41	5	36	231	148	83	8318	8394	12.0	10.3
1981.0	41	5	36	231	148	83	8323	8400	8.6	10.3
1982.0	41	5	36	231	148	83	8330	8406	12.0	10.3
1983.0	41	5	36	231	148	83	8334	8412	6.8	10.3
1984.0	41	5	36	231	148	83	8337	8415	5.1	5.1
1985.1	41	5	36	231	148	83	8340	8418	5.1	5.1
1986.1	41	5	36	231	148	83	8343	8421	5.1	5.1
1987.1	41	5	36	231	148	83	8346	8423	5.1	3.4
1988.1	41	5	36	231	148	83	8350	8427	6.8	6.8
1989.1	41	5	36	231	148	83	8353	8430	5.1	5.1
1990.2	41	5	36	231	148	83	8357	8434	6.8	6.8
1991.2	41	5	36	231	148	83	8361	8438	6.8	6.8
1992.2	41	5	36	231	148	83	8366	8442	8.6	6.8
1993.2	42	5	37	231	148	83	8370	8446	6.8	6.8
1994.3	42	5	37	231	148	83	8375	8451	8.6	8.6
1995.3	42	5	37	231	148	83	8380	8456	8.6	8.6
1996.3	42	5	37	231	148	83	8386	8462	10.3	10.3
1997.3	42	5	37	231	148	83	8391	8467	8.6	8.6
1998.4	42	5	37	231	148	83	8396	8473	8.6	10.3
1999.4	42	5	37	231	148	83	8401	8478	8.6	8.6
2000.4	42	5	37	231	148	83	8406	8482	8.6	6.8
2001.4	42	5	37	231	148	83	8410	8486	6.8	6.8
2002.5	42	5	37	231	148	83	8414	8489	6.8	5.1
2003.5	42	5	37	231	148	83	8417	8493	5.1	6.8
2004.5	42	5	37	231	148	83	8421	8496	6.8	5.1
2005.5	42	5	37	231	148	83	8424	8499	5.1	5.1
2006.6	42	5	37	231	148	83	8427	8503	5.1	6.8
2007.6	42	5	37	231	148	83	8430	8506	5.1	5.1
2008.6	42	5	37	231	148	83	8434	8510	6.8	6.8
2009.6	42	5	37	231	148	83	8438	8514	6.8	6.8
2010.6	42	5	37	231	148	83	8442	8518	6.8	6.8
2011.7	42	5	37	231	148	83	8446	8522	6.8	6.8
2012.7	42	5	37	231	148	83	8451	8526	8.6	6.8
2013.7	42	5	37	231	148	83	8455	8531	6.8	8.6
2014.7	42	5	37	231	148	83	8460	8535	8.6	6.8
2015.8	42	5	37	231	148	83	8465	8541	8.6	10.3
2016.8	42	5	37	231	148	83	8470	8546	8.6	8.6
2017.8	42	5	37	231	148	83	8476	8552	10.3	10.3
2018.8	42	5	37	231	148	83	8481	8558	8.6	10.3
2019.9	42	5	37	231	148	83	8488	8564	12.0	10.3
2020.9	42	5	37	231	148	83	8494	8571	10.3	12.0
2021.9	42	5	37	231	148	83	8500	8577	10.3	10.3
2022.9	42	5	37	231	148	83	8506	8583	10.3	10.3
2024.0	42	5	37	231	148	83	8511	8589	8.6	10.3
2025.0	42	5	37	231	148	83	8517	8594	10.3	8.6
2026.0	42	5	37	231	148	83	8523	8600	10.3	10.3
2027.0	42	5	37	231	148	83	8529	8606	10.3	10.3

TIME SEC.	R+ CNTS	R- CNTS	TOTAL R CNTS	B+ CNTS	B- CNTS	TOTAL B CNTS	ORF CNTS	CLK CNTS	SPEED-RF KM/HR.	SPEED-LR KM/HR.
2028.0	42	5	37	231	148	83	8534	8611	8.6	8.6
2029.1	42	5	37	231	148	83	8539	8617	8.6	10.3
2030.1	42	5	37	231	148	83	8544	8621	8.6	6.8
2031.1	42	5	37	231	148	83	8548	8626	6.8	8.6
2032.1	42	5	37	231	148	83	8553	8630	8.6	6.8
2033.2	42	5	37	231	148	83	8557	8634	6.8	6.8
2034.2	42	5	37	231	148	83	8562	8638	8.6	6.8
2035.2	42	5	37	231	148	83	8566	8643	6.8	8.6
2036.2	42	5	37	231	148	83	8571	8648	8.6	8.6
2037.3	42	5	37	231	148	83	8576	8653	8.6	8.6
2038.3	43	5	38	231	148	83	8582	8659	10.3	10.3
2039.3	43	5	38	231	148	83	8588	8665	10.3	10.3
2040.3	43	5	38	231	148	83	8594	8671	10.3	10.3
2041.4	43	5	38	231	148	83	8600	8678	10.3	12.0
2042.4	43	5	38	231	148	83	8606	8684	10.3	10.3
2043.4	43	5	38	231	148	83	8612	8689	10.3	8.6
2044.4	43	5	38	231	148	83	8618	8694	10.3	8.6
2045.5	43	5	38	231	148	83	8623	8699	8.6	8.6
2046.5	43	5	38	231	148	83	8628	8703	8.6	6.8
2047.5	43	5	38	231	148	83	8633	8708	8.6	8.6
2048.5	43	5	38	231	148	83	8637	8712	6.8	6.8
2049.5	43	5	38	231	148	83	8641	8717	6.8	8.6
2050.6	43	5	38	231	148	83	8645	8721	6.8	6.8
2051.6	43	5	38	231	148	83	8649	8725	6.8	6.8
2052.6	43	5	38	231	148	83	8653	8729	6.8	6.8
2053.6	43	5	38	231	148	83	8656	8732	5.1	5.1
2054.7	43	5	38	231	148	83	8660	8736	6.8	6.8
2055.7	43	5	38	231	148	83	8663	8740	5.1	6.8
2056.7	43	5	38	231	148	83	8666	8743	5.1	5.1
2057.7	43	5	38	231	148	83	8669	8745	5.1	3.4
2058.8	43	5	38	231	148	83	8671	8748	3.4	5.1
2059.8	43	5	38	231	148	83	8673	8751	3.4	5.1
2060.8	43	5	38	231	148	83	8675	8753	3.4	3.4
2061.8	43	5	38	231	148	83	8677	8755	3.4	3.4
2062.9	43	5	38	231	148	83	8679	8757	3.4	3.4
2063.9	43	5	38	231	148	83	8682	8760	5.1	5.1
2064.9	43	5	38	231	148	83	8684	8762	3.4	3.4
2065.9	43	5	38	231	148	83	8686	8764	3.4	3.4
2067.0	43	5	38	231	148	83	8688	8767	3.4	5.1
2068.0	43	5	38	231	148	83	8691	8769	5.1	3.4
2069.0	43	5	38	231	148	83	8693	8771	3.4	3.4
2070.0	43	5	38	231	148	83	8696	8773	5.1	3.4
2071.0	43	5	38	231	148	83	8698	8775	3.4	3.4
2072.1	43	5	38	231	148	83	8700	8777	3.4	3.4
2073.1	43	5	38	231	148	83	8703	8779	5.1	3.4
2074.1	43	5	38	231	148	83	8704	8781	1.7	3.4
2075.1	43	5	38	231	148	83	8705	8783	1.7	3.4
2076.2	43	5	38	231	148	83	8707	8784	3.4	1.7
2077.2	43	5	38	231	148	83	8708	8786	1.7	3.4
2078.2	43	5	38	231	148	83	8709	8787	1.7	1.7
2079.2	43	5	38	231	148	83	8710	8789	1.7	3.4
2080.3	43	5	38	231	148	83	8711	8789	.0	.0
2081.3	43	5	38	231	148	83	8711	8789	.0	.0
2082.3	43	5	38	231	148	83	8711	8789	.0	.0
2083.3	43	5	38	231	148	83	8711	8789	.0	.0
2084.4	43	5	38	231	148	83	8711	8789	.0	.0
2085.4	43	5	38	231	148	83	8711	8789	.0	.0
2086.4	43	5	38	231	148	83	8711	8789	.0	.0
2087.4	43	5	38	231	148	83	8711	8789	.0	.0
2088.5	43	5	38	231	148	83	8711	8789	.0	.0

TIME SEC.	R+ CNTS	R- CNTS	TOTAL R CNTS	L+ CNTS	L- CNTS	TOTAL L CNTS	ORF CNTS	OLR CNTS	SPEED-RF KM/HR.		SPEED-L KM/HR.
2089.5	43	5	38	231	148	83	8711	8789	.0		.0
2090.5	43	5	38	231	148	83	8711	8789	.0		.0
2091.5	43	5	38	231	148	83	8711	8789	.0		.0
2092.5	43	5	38	231	148	83	8711	8789	.0		.0
2093.6	43	5	38	231	148	83	8711	8789	.0		.0
2094.6	43	5	38	231	148	83	8711	8789	.0		.0
2095.6	43	5	38	231	148	83	8711	8789	.0		.0
2096.6	43	5	38	231	148	83	8711	8789	.0		.0
2097.7	43	5	38	231	148	83	8711	8789	.0		.0
2098.7	43	5	38	231	148	83	8711	8789	.0		.0
2099.7	43	5	38	231	148	83	8711	8789	.0		.0
2100.7	43	5	38	231	148	83	8711	8789	.0		.0
2101.8	43	5	38	231	148	83	8711	8789	.0		.0
2102.8	43	5	38	231	148	83	8711	8789	.0		.0
2103.8	43	5	38	231	148	83	8711	8789	.0		.0
2104.8	43	5	38	231	148	83	8711	8789	.0		.0
2105.9	43	5	38	231	148	83	8711	8789	.0		.0
2106.9	43	5	38	231	148	83	8711	8789	.0		.0
2107.9	43	5	38	231	148	83	8711	8789	.0		.0
2108.9	43	5	38	231	148	83	8711	8789	.0		.0
2109.9	43	5	38	231	148	83	8711	8789	.0		.0
2111.0	43	5	38	231	148	83	8711	8789	.0		.0
2112.0	43	5	38	231	148	83	8711	8789	.0		.0
2113.0	43	5	38	231	148	83	8711	8789	.0		.0
2114.0	43	5	38	231	148	83	8711	8789	.0		.0
2115.1	43	5	38	231	148	83	8711	8789	.0		.0
2116.1	43	5	38	231	148	83	8711	8789	.0		.0
2117.1	43	5	38	231	148	83	8711	8789	.0		.0
2118.1	43	5	38	231	148	83	8711	8789	.0		.0
2119.2	43	5	38	231	148	83	8711	8789	.0		.0
2120.2	43	5	38	231	148	83	8711	8789	.0		.0
2121.2	43	5	38	231	148	83	8711	8789	.0	LRV-2	.0
2122.2	43	5	38	231	148	83	8711	8789	.0		.0
2123.3	43	5	38	231	148	83	8711	8789	.0		.0
2124.3	43	5	38	231	148	83	8711	8789	.0		.0
2125.3	43	5	38	231	148	83	8711	8789	.0		.0
2126.3	43	5	38	231	148	83	8711	8789	.0		.0
2127.4	43	5	38	231	148	83	8711	8789	.0		.0
2128.4	43	5	38	231	148	83	8711	8789	.0		.0
2129.4	43	5	38	231	148	83	8711	8789	.0		.0
2130.4	43	5	38	231	148	83	8711	8789	.0		.0
2131.4	43	5	38	231	148	83	8711	8789	.0		.0
2132.5	43	5	38	231	148	83	8711	8789	.0		.0
2133.5	43	5	38	231	148	83	8711	8789	.0		.0
2134.5	43	5	38	231	148	83	8711	8789	.0		.0
2135.5	43	5	38	231	148	83	8711	8789	.0		.0
2136.6	43	5	38	231	148	83	8711	8789	.0		.0
2137.6	43	5	38	231	148	83	8711	8789	.0		.0
2138.6	43	5	38	231	148	83	8711	8789	.0		.0
2139.6	43	5	38	231	148	83	8711	8789	.0		.0
2140.7	43	5	38	231	148	83	8711	8789	.0		.0
2141.7	43	5	38	231	148	83	8711	8789	.0		.0
2142.7	43	5	38	231	148	83	8711	8789	.0		.0
2143.7	43	5	38	231	148	83	8711	8789	.0		.0
2144.8	43	5	38	231	148	83	8711	8789	.0		.0
2145.8	43	5	38	231	148	83	8711	8789	.0		.0
2146.8	43	5	38	231	148	83	8711	8789	.0		.0
2147.8	43	5	38	231	148	83	8711	8789	.0		.0
2148.9	43	5	38	231	148	83	8711	8789	.0		.0
2149.9	43	5	38	231	148	83	8711	8789	.0		.0

TIME SEC.	R+ CNTS	R- CNTS	TOTAL R CNTS	B+ CNTS	B- CNTS	TOTAL B CNTS	ORF CNTS	OLR CNTS	SPEED-RT KM/HR.	SPEED-LR KM/HR.
2150.9	43	5	38	231	148	83	8711	8789	.0	.0
2151.9	43	5	38	231	148	83	8711	8789	.0	.0
2152.9	43	5	38	231	148	83	8711	8789	.0	.0
2154.0	43	5	38	231	148	83	8711	8789	.0	.0
2155.0	43	5	38	231	148	83	8711	8789	.0	.0
2156.0	43	5	38	231	148	83	8711	8789	.0	.0
2157.0	43	5	38	231	148	83	8711	8789	.0	.0
2158.1	43	5	38	231	148	83	8711	8789	.0	.0
2159.1	43	5	38	231	148	83	8711	8789	.0	.0
2160.1	43	5	38	231	148	83	8711	8789	.0	.0
2161.1	43	5	38	231	148	83	8711	8789	.0	.0
2162.2	43	5	38	231	148	83	8711	8789	.0	.0
2163.2	43	5	38	231	148	83	8711	8789	.0	.0
2164.2	43	5	38	231	148	83	8711	8789	.0	.0
2165.2	43	5	38	231	148	83	8711	8790	.0	1.7
2166.3	43	5	38	231	148	83	8712	8790	1.7	.0
2167.3	43	5	38	231	148	83	8713	8791	1.7	1.7
2168.3	43	5	38	231	148	83	8715	8793	3.4	3.4
2169.3	43	5	38	231	148	83	8716	8794	1.7	1.7
2170.4	43	5	38	231	148	83	8718	8796	3.4	3.4
2171.4	43	5	38	231	148	83	8720	8798	3.4	3.4
2172.4	43	5	38	231	148	83	8722	8800	3.4	3.4
2173.4	43	5	38	231	148	83	8725	8802	5.1	3.4
2174.4	43	5	38	231	148	83	8728	8805	5.1	5.1
2175.5	43	5	38	231	148	83	8732	8809	6.8	5.1
2176.5	43	5	38	231	148	83	8736	8812	6.8	5.1
2177.5	43	5	38	231	148	83	8740	8816	6.8	6.8
2178.5	43	5	38	231	148	83	8744	8820	6.8	6.8
2179.6	43	5	38	231	148	83	8748	8825	6.8	8.6
2180.6	43	5	38	231	148	83	8752	8829	6.8	6.8
2181.6	43	5	38	231	148	83	8756	8833	6.8	6.8
2182.6	43	5	38	231	148	83	8761	8837	6.8	6.8
2183.7	43	5	38	231	148	83	8765	8842	6.8	6.8
2184.7	43	5	38	231	148	83	8769	8846	6.8	6.8
2185.7	43	5	38	231	148	83	8773	8850	6.8	6.8
2186.7	43	5	38	231	148	83	8777	8854	6.8	6.8
2187.8	43	5	38	231	148	83	8781	8859	6.8	6.8
2188.8	43	5	38	231	148	83	8785	8863	6.8	6.8
2189.8	43	5	38	231	148	83	8790	8867	6.8	6.8
2190.8	43	5	38	231	148	83	8794	8871	6.8	6.8
2191.8	44	5	39	231	148	83	8798	8875	6.8	6.8
2192.9	44	5	39	231	148	83	8802	8879	6.8	6.8
2193.9	44	5	39	231	148	83	8806	8883	6.8	6.8
2194.9	44	5	39	231	148	83	8810	8887	6.8	6.8
2195.9	44	5	39	231	148	83	8814	8891	6.8	6.8
2197.0	44	5	39	231	148	83	8818	8895	6.8	6.8
2198.0	44	5	39	231	148	83	8822	8899	6.8	6.8
2199.0	44	5	39	231	148	83	8826	8903	6.8	6.8
2200.0	44	5	39	231	148	83	8830	8907	6.8	6.8
2201.1	44	5	39	231	148	83	8834	8911	6.8	6.8
2202.1	44	5	39	231	148	83	8838	8915	6.8	6.8
2203.1	44	5	39	231	148	83	8843	8920	8.6	8.6
2204.1	44	5	39	231	148	83	8847	8924	6.8	6.8
2205.2	44	5	39	231	148	83	8851	8929	6.8	8.6
2206.2	44	5	39	231	148	83	8856	8933	8.6	6.8
2207.2	44	5	39	231	148	83	8861	8938	8.6	8.6
2208.2	44	5	39	231	148	83	8866	8942	8.6	6.8
2209.3	44	5	39	231	148	83	8870	8946	6.8	6.8
2210.3	44	5	39	231	148	83	8875	8950	8.6	6.8
2211.3	44	5	39	231	148	83	8879	8954	6.8	6.8

TIME SEC.	R+ CNTS	R- CNTS	TOTAL R CNTS	B+ CNTS	B- CNTS	TOTAL B CNTS	ORF CNTS	OLR CNTS	SPEED-RF KM/HR.	SPEED-L KM/HR.
2212.3	44	5	39	231	148	83	8883	8959	6.8	8.6
2213.3	44	5	39	231	148	83	8888	8964	8.6	8.6
2214.4	44	5	39	231	148	83	8893	8969	8.6	8.6
2215.4	44	5	39	231	148	83	8897	8973	6.8	6.8
2216.4	44	5	39	231	148	83	8901	8978	6.8	8.6
2217.4	44	5	39	231	148	83	8905	8982	6.8	6.8
2218.5	44	5	39	231	148	83	8909	8986	6.8	6.8
2219.5	44	5	39	231	148	83	8913	8991	6.8	8.6
2220.5	44	5	39	231	148	83	8917	8995	6.8	6.8
2221.5	44	5	39	231	148	83	8922	9000	8.6	8.6
2222.6	44	5	39	231	148	83	8926	9004	6.8	6.8
2223.6	44	5	39	231	148	83	8931	9009	8.6	8.6
2224.6	44	5	39	231	148	83	8935	9013	6.8	6.8
2225.6	44	5	39	231	148	83	8940	9018	8.6	8.6
2226.7	44	5	39	231	148	83	8945	9023	8.6	8.6
2227.7	44	5	39	231	148	83	8951	9029	10.3	10.3
2228.7	44	5	39	231	148	83	8956	9034	8.6	8.6
2229.7	44	5	39	231	148	83	8962	9040	10.3	10.3
2230.8	44	5	39	231	148	83	8968	9046	10.3	10.3
2231.8	44	5	39	231	148	83	8973	9051	8.6	8.6
2232.8	44	5	39	231	148	83	8979	9057	10.3	10.3
2233.8	44	5	39	231	148	83	8985	9063	10.3	10.3
2234.8	44	5	39	231	148	83	8991	9069	10.3	10.3
2235.9	44	5	39	231	148	83	8997	9075	10.3	10.3
2236.9	44	5	39	231	148	83	9003	9082	10.3	12.0
2237.9	45	5	40	231	148	83	9010	9088	12.0	10.3
2238.9	45	5	40	231	148	83	9015	9094	8.6	10.3
2240.0	45	5	40	231	148	83	9021	9099	10.3	8.6
2241.0	45	5	40	231	148	83	9027	9105	10.3	10.3
2242.0	45	5	40	231	148	83	9031	9109	6.8	8.6
2243.0	45	5	40	231	148	83	9036	9114	8.6	8.6
2244.1	45	5	40	231	148	83	9040	9119	6.8	8.6
2245.1	45	5	40	231	148	83	9043	9122	5.1	5.1
2246.1	45	5	40	231	148	83	9047	9126	6.8	6.8
2247.1	45	5	40	231	148	83	9050	9129	5.1	5.1
2248.2	45	5	40	231	148	83	9054	9132	6.8	5.1
2249.2	45	5	40	231	148	83	9057	9135	5.1	5.1
2250.2	45	5	40	231	148	83	9060	9138	5.1	5.1
2251.2	45	5	40	231	148	83	9064	9141	6.8	5.1
2252.3	45	5	40	231	148	83	9067	9143	5.1	3.4
2253.3	45	5	40	231	148	83	9071	9147	6.8	6.8
2254.3	45	5	40	231	148	83	9076	9152	8.6	8.6
2255.3	45	5	40	231	148	83	9081	9156	8.6	8.6
2256.3	45	5	40	231	148	83	9085	9161	6.8	8.6
2257.4	45	5	40	231	148	83	9090	9167	8.6	10.3
2258.4	45	5	40	231	148	83	9096	9172	10.3	8.6
2259.4	45	5	40	231	148	83	9101	9178	8.6	10.3
2260.4	45	5	40	231	148	83	9106	9184	8.6	10.3
2261.5	45	5	40	231	148	83	9111	9190	8.6	10.3
2262.5	45	5	40	231	148	83	9116	9195	8.6	8.6
2263.5	45	5	40	231	148	83	9121	9200	8.6	8.6
2264.5	45	5	40	231	148	83	9126	9206	8.6	10.3
2265.6	45	5	40	231	149	82	9131	9212	8.6	10.3
2266.6	45	5	40	231	149	82	9136	9217	8.6	8.6
2267.6	45	5	40	231	149	82	9141	9222	8.6	8.6
2268.6	45	5	40	231	149	82	9145	9227	6.8	8.6
2269.7	45	5	40	231	149	82	9150	9232	8.6	8.6
2270.7	45	5	40	231	149	82	9154	9236	6.8	6.8
2271.7	45	5	40	231	149	82	9157	9240	5.1	6.8
2272.7	45	5	40	232	149	83	9162	9245	8.6	8.6

TIME SEC.	R+ CNTS	R- CNTS	TOTAL R CNTS	L+ CNTS	L- CNTS	TOTAL B CNTS	ORF CNTS	OLR CNTS	SPEED-RF KM/HR.	SPEED-LF KM/HR.
2273.7	45	5	40	232	149	83	9167	9249	8.6	6.8
2274.8	45	5	40	232	149	83	9172	9255	8.6	10.3
2275.8	45	5	40	232	149	83	9177	9259	8.6	6.8
2276.8	45	5	40	232	149	83	9181	9264	6.8	8.6
2277.8	45	5	40	232	149	83	9186	9269	8.6	8.6
2278.9	45	5	40	232	149	83	9191	9273	8.6	6.8
2279.9	45	5	40	232	149	83	9195	9278	6.8	8.6
2280.9	45	5	40	232	149	83	9199	9282	6.8	6.8
2281.9	45	5	40	232	149	83	9204	9287	8.6	8.6
2283.0	45	5	40	232	149	83	9209	9292	8.6	8.6
2284.0	45	5	40	232	149	83	9214	9297	8.6	8.6
2285.0	45	5	40	232	149	83	9220	9303	10.3	10.3
2286.0	45	5	40	232	149	83	9227	9308	12.0	8.6
2287.1	45	5	40	232	149	83	9233	9313	10.3	8.6
2288.1	45	5	40	232	149	83	9237	9319	6.8	10.3
2289.1	46	5	41	232	149	83	9243	9324	10.3	8.6
2290.1	46	5	41	232	149	83	9248	9329	8.6	8.6
2291.2	46	5	41	232	149	83	9253	9334	8.6	8.6
2292.2	46	5	41	232	149	83	9258	9340	8.6	10.3
2293.2	46	5	41	232	149	83	9264	9345	10.3	8.6
2294.2	46	5	41	232	149	83	9269	9350	8.6	8.6
2295.2	46	5	41	232	149	83	9274	9356	8.6	10.3
2296.3	46	5	41	232	149	83	9279	9361	8.6	8.6
2297.3	46	5	41	232	149	83	9284	9365	8.6	6.8
2298.3	46	5	41	232	149	83	9289	9369	8.6	6.8
2299.3	46	5	41	232	149	83	9293	9373	6.8	6.8
2300.4	46	5	41	232	149	83	9298	9377	8.6	6.8
2301.4	46	5	41	232	149	83	9302	9382	6.8	8.6
2302.4	46	5	41	232	149	83	9307	9388	8.6	10.3
2303.4	46	5	41	232	149	83	9312	9393	8.6	8.6
2304.5	46	5	41	232	149	83	9318	9398	10.3	8.6
2305.5	46	5	41	232	149	83	9324	9403	10.3	8.6
2306.5	46	5	41	232	149	83	9332	9410	15.7	12.0
2307.5	46	5	41	232	149	83	9338	9416	10.3	10.3
2308.6	46	5	41	232	149	83	9343	9421	8.6	8.6
2309.6	46	5	41	232	149	83	9348	9426	8.6	8.6
2310.6	46	5	41	232	150	82	9353	9431	8.6	8.6
2311.6	46	5	41	232	150	82	9358	9437	8.6	10.3
2312.7	46	5	41	232	150	82	9362	9443	6.8	10.3
2313.7	46	5	41	232	150	82	9367	9447	8.6	6.8
2314.7	46	5	41	232	150	82	9372	9452	8.6	8.6
2315.7	46	5	41	232	150	82	9376	9456	6.8	6.8
2316.7	46	5	41	232	150	82	9380	9460	6.8	6.8
2317.8	46	5	41	232	150	82	9384	9465	6.8	8.6
2318.8	46	5	41	232	150	82	9389	9469	8.6	6.8
2319.8	46	5	41	232	150	82	9393	9473	6.8	6.8
2320.8	46	5	41	232	150	82	9398	9478	8.6	8.6
2321.9	46	5	41	232	150	82	9403	9483	8.6	8.6
2322.9	46	5	41	232	150	82	9408	9487	8.6	6.8
2323.9	46	5	41	232	150	82	9413	9492	8.6	8.6
2324.9	46	5	41	232	150	82	9417	9495	6.8	5.1
2326.0	46	5	41	232	150	82	9421	9499	6.8	6.8
2327.0	46	5	41	233	150	83	9424	9502	5.1	5.1
2328.0	46	5	41	233	150	83	9428	9505	6.8	5.1
2329.0	46	5	41	233	150	83	9432	9508	6.8	5.1
2330.1	46	5	41	233	150	83	9436	9512	6.8	6.8
2331.1	46	5	41	233	150	83	9439	9516	5.1	6.8
2332.1	46	5	41	233	150	83	9443	9520	6.8	6.8
2333.1	46	5	41	233	150	83	9446	9525	5.1	8.6
2334.2	46	5	41	233	150	83	9451	9529	8.6	6.8

TIME SEC.	R+ CNTS	R- CNTS	TOTAL R CNTS	L+ CNTS	B- CNTS	TOTAL B CNTS	ORF CNTS	OLR CNTS	SPEED-RF KM/HR.	SPEED-L KM/HR.
2335.2	46	5	41	233	150	83	9457	9533	10.3	6.8
2336.2	46	5	41	233	151	82	9462	9539	8.6	10.3
2337.2	46	5	41	233	151	82	9467	9544	8.6	8.6
2338.2	46	5	41	233	151	82	9472	9549	8.6	8.6
2339.3	46	5	41	233	151	82	9478	9555	10.3	10.3
2340.3	46	5	41	233	151	82	9484	9561	10.3	10.3
2341.3	46	5	41	233	151	82	9490	9566	10.3	8.6
2342.3	46	5	41	233	151	82	9495	9572	8.6	10.3
2343.4	46	5	41	233	151	82	9500	9577	8.6	8.6
2344.4	46	5	41	233	151	82	9505	9582	8.6	8.6
2345.4	46	5	41	233	151	82	9509	9587	6.8	8.6
2346.4	46	5	41	233	151	82	9514	9592	8.6	8.6
2347.5	46	5	41	233	151	82	9518	9597	6.8	8.6
2348.5	47	5	42	233	151	82	9523	9601	8.6	6.8
2349.5	47	5	42	233	151	82	9527	9606	6.8	8.6
2350.5	47	5	42	233	151	82	9532	9610	8.6	6.8
2351.6	47	5	42	233	151	82	9536	9613	6.8	5.1
2352.6	47	5	42	233	151	82	9540	9618	6.8	8.6
2353.6	47	5	42	233	151	82	9544	9623	6.8	8.6
2354.6	47	5	42	233	151	82	9549	9628	8.6	8.6
2355.6	47	5	42	233	151	82	9554	9633	8.6	8.6
2356.7	47	5	42	233	151	82	9559	9638	8.6	8.6
2357.7	47	5	42	233	151	82	9564	9644	8.6	10.3
2358.7	47	5	42	233	151	82	9570	9650	10.3	10.3
2359.7	47	5	42	233	151	82	9575	9656	8.6	10.3
2360.8	47	5	42	233	151	82	9581	9662	10.3	10.3
2361.8	47	5	42	233	151	82	9586	9668	8.6	10.3
2362.8	47	5	42	233	151	82	9592	9673	10.3	8.6
2363.8	47	5	42	233	151	82	9597	9680	8.6	12.0
2364.9	47	5	42	233	151	82	9604	9686	12.0	10.3
2365.9	47	5	42	233	151	82	9611	9693	12.0	12.0
2366.9	47	5	42	233	151	82	9617	9700	10.3	12.0
2367.9	47	5	42	233	151	82	9624	9707	12.0	12.0
2369.0	47	5	42	233	151	82	9631	9714	12.0	12.0
2370.0	47	5	42	233	151	82	9638	9721	12.0	12.0
2371.0	47	5	42	233	151	82	9645	9728	12.0	12.0
2372.0	47	5	42	233	151	82	9652	9735	12.0	12.0
2373.1	47	5	42	233	151	82	9659	9742	12.0	12.0
2374.1	47	5	42	233	151	82	9666	9749	12.0	12.0
2375.1	47	5	42	233	151	82	9672	9756	10.3	12.0
2376.1	47	5	42	233	151	82	9678	9761	10.3	8.6
2377.1	47	5	42	233	151	82	9684	9766	10.3	8.6
2378.2	47	5	42	233	151	82	9690	9772	10.3	10.3
2379.2	47	5	42	233	151	82	9695	9777	8.6	8.6
2380.2	47	5	42	233	151	82	9700	9783	8.6	10.3
2381.2	47	5	42	233	151	82	9706	9788	10.3	8.6
2382.3	47	5	42	233	151	82	9710	9794	6.8	10.3
2383.3	47	5	42	233	151	82	9714	9799	6.8	8.6
2384.3	47	5	42	233	151	82	9719	9804	8.6	8.6
2385.3	47	5	42	233	151	82	9723	9808	6.8	6.8
2386.4	47	5	42	233	151	82	9728	9813	8.6	8.6
2387.4	47	5	42	233	151	82	9732	9817	6.8	6.8
2388.4	47	5	42	233	151	82	9737	9822	8.6	8.6
2389.4	48	5	43	233	151	82	9742	9828	8.6	10.3
2390.5	48	5	43	233	151	82	9748	9833	10.3	8.6
2391.5	48	5	43	233	151	82	9753	9839	8.6	10.3
2392.5	48	5	43	233	151	82	9759	9845	10.3	10.3
2393.5	48	5	43	233	151	82	9765	9851	10.3	10.3
2394.6	48	5	43	233	151	82	9771	9857	10.3	10.3
2395.6	48	5	43	233	151	82	9777	9862	10.3	8.6

TIME SEC.	R+ CNTS	R- CNTS	TOTAL R CNTS	L+ CNTS	L- CNTS	TOTAL L CNTS	ORF CNTS	OLR CNTS	SPEED-RF KM/HR.	SPEED-LF KM/HR.
2396.6	48	5	43	233	151	82	9782	9867	8.6	8.6
2397.6	48	5	43	233	151	82	9787	9872	8.6	8.6
2398.6	48	5	43	233	151	82	9792	9877	8.6	8.6
2399.7	48	5	43	233	151	82	9798	9883	10.3	10.3
2400.7	48	5	43	233	151	82	9803	9888	8.6	8.6
2401.7	48	5	43	233	151	82	9809	9894	10.3	10.3
2402.7	48	5	43	233	151	82	9814	9900	8.6	10.3
2403.8	48	5	43	233	151	82	9820	9905	10.3	8.6
2404.8	48	5	43	233	151	82	9825	9911	8.6	10.3
2405.8	48	5	43	233	151	82	9830	9916	8.6	8.6
2406.8	48	5	43	233	151	82	9835	9920	8.6	8.6
2407.9	48	5	43	233	151	82	9839	9924	6.8	6.8
2408.9	48	5	43	233	151	82	9842	9928	5.1	6.8
2409.9	48	5	43	233	151	82	9846	9931	6.8	5.1
2410.9	48	5	43	233	151	82	9849	9935	5.1	6.8
2412.0	48	5	43	233	151	82	9853	9938	6.8	5.1
2413.0	48	5	43	233	151	82	9856	9942	5.1	6.8
2414.0	48	5	43	233	151	82	9860	9945	6.8	5.1
2415.0	48	5	43	233	151	82	9864	9949	6.8	6.8
2416.1	48	5	43	233	151	82	9868	9954	6.8	6.8
2417.1	48	5	43	233	151	82	9872	9958	6.8	6.8
2418.1	48	5	43	233	151	82	9876	9962	6.8	6.8
2419.1	48	5	43	233	151	82	9879	9965	5.1	5.1
2420.1	48	5	43	233	151	82	9881	9968	3.4	5.1
2421.2	48	5	43	233	151	82	9884	9971	5.1	5.1
2422.2	48	5	43	233	151	82	9889	9974	8.6	5.1
2423.2	48	5	43	233	151	82	9891	9977	3.4	5.1
2424.2	48	5	43	233	151	82	9893	9979	3.4	3.4
2425.3	48	5	43	233	151	82	9895	9982	3.4	5.1
2426.3	48	5	43	233	151	82	9897	9984	3.4	3.4
2427.3	48	5	43	233	151	82	9898	9985	1.7	1.7
2428.3	48	5	43	233	151	82	9898	9987	.0	3.4
2429.4	48	5	43	233	151	82	9899	9988	1.7	1.7
2430.4	48	5	43	233	151	82	9900	9989	1.7	1.7
2431.4	48	5	43	233	151	82	9901	9990	1.7	1.7
2432.4	48	5	43	233	151	82	9901	9990	.0	.0
2433.5	48	5	43	233	151	82	9901	9990	.0	.0
2434.5	48	5	43	233	151	82	9901	9990	.0	.0
2435.5	48	5	43	233	151	82	9901	9991	.0	1.7
2436.5	48	5	43	233	151	82	9901	9991	.0	.0
2437.5	48	5	43	233	151	82	9901	9991	.0	.0
2438.6	48	5	43	233	151	82	9901	9991	.0	.0
2439.6	48	5	43	233	151	82	9901	9991	.0	.0
2440.6	48	5	43	233	151	82	9901	9991	.0	.0
2441.6	48	5	43	233	151	82	9901	9991	.0	.0
2442.7	48	5	43	233	151	82	9901	9991	.0	.0
2443.7	48	5	43	233	151	82	9901	9991	.0	.0
2444.7	48	5	43	233	151	82	9901	9991	.0	.0
2445.7	48	5	43	233	151	82	9901	9991	.0	.0
2446.8	48	5	43	233	151	82	9901	9991	.0	.0
2447.8	48	5	43	233	151	82	9901	9991	.0	.0
2448.8	48	5	43	233	151	82	9901	9991	.0	.0
2449.8	48	5	43	233	151	82	9901	9991	.0	.0
2450.9	48	5	43	233	151	82	9901	9991	.0	.0
2451.9	48	5	43	233	151	82	9901	9991	.0	.0
2452.9	48	5	43	233	151	82	9901	9991	.0	.0
2453.9	48	5	43	233	151	82	9901	9991	.0	.0
2455.0	48	5	43	233	151	82	9901	9991	.0	.0
2456.0	48	5	43	233	151	82	9901	9991	.0	.0
2457.0	48	5	43	233	151	82	9901	9991	.0	.0

TIME SEC.	R+ CNTS	R- CNTS	TOTAL R CNTS	B+ CNTS	B- CNTS	TOTAL B CNTS	ORF CNTS	OLR CNTS	SPEED-RF KM/HR.	SPEED-LE KM/HR.
2458.0	48	5	43	233	151	82	9901	9991	.0	.0
2459.0	48	5	43	233	151	82	9901	9991	.0	.0
2460.1	48	5	43	233	151	82	9901	9991	.0	.0
2461.1	48	5	43	233	151	82	9901	9991	.0	.0
2462.1	48	5	43	233	151	82	9901	9991	.0	.0
2463.1	48	5	43	233	151	82	9901	9991	.0	.0
2464.2	48	5	43	233	151	82	9901	9991	.0	.0
2465.2	48	5	43	233	151	82	9901	9991	.0	.0
2466.2	48	5	43	233	151	82	9901	9991	.0	.0
2467.2	48	5	43	233	151	82	9901	9991	.0	.0
2468.3	48	5	43	233	151	82	9901	9991	.0	.0
2469.3	48	5	43	233	151	82	9901	9991	.0	.0
2470.3	48	5	43	233	151	82	9901	9991	.0	.0
2471.3	48	5	43	233	151	82	9901	9991	.0	.0
2472.4	48	5	43	233	151	82	9901	9991	.0	.0
2473.4	48	5	43	233	151	82	9901	9991	.0	.0
2474.4	48	5	43	233	151	82	9901	9991	.0	.0
2475.4	48	5	43	233	151	82	9901	9991	.0	.0
2476.5	48	5	43	233	151	82	9901	9991	.0	.0
2477.5	48	5	43	233	151	82	9901	9991	.0	.0
2478.5	48	5	43	233	151	82	9901	9991	.0	.0
2479.5	48	5	43	233	151	82	9901	9991	.0	.0
2480.5	48	5	43	233	151	82	9901	9991	.0	.0
2481.6	48	5	43	233	151	82	9901	9991	.0	.0
2482.6	48	5	43	233	151	82	9901	9991	.0	.0
2483.6	48	5	43	233	151	82	9901	9991	.0	.0
2484.6	48	5	43	233	151	82	9901	9991	.0	.0
2485.7	48	5	43	233	151	82	9901	9991	.0	.0
2486.7	48	5	43	233	151	82	9901	9991	.0	.0
2487.7	48	5	43	233	151	82	9901	9991	.0	.0
2488.7	48	5	43	233	151	82	9901	9991	.0	.0
2489.8	48	5	43	233	151	82	9901	9991	.0	.0
2490.8	48	5	43	233	151	82	9901	9991	.0	.0
2491.8	48	5	43	233	151	82	9901	9991	.0	.0
2492.8	48	5	43	233	151	82	9901	9991	.0	.0
2493.9	48	5	43	233	151	82	9901	9991	.0	.0
2494.9	48	5	43	233	151	82	9901	9991	.0	.0
2495.9	48	5	43	233	151	82	9901	9991	.0	.0
2496.9	48	5	43	233	151	82	9901	9991	.0	.0
2498.0	48	5	43	233	151	82	9901	9991	.0	.0
2499.0	48	5	43	233	151	82	9901	9991	.0	.0
2500.0	48	5	43	233	151	82	9901	9991	.0	.0
2501.0	48	5	43	233	151	82	9901	9991	.0	.0
2502.0	48	5	43	233	151	82	9901	9991	.0	.0
2503.1	48	5	43	233	151	82	9901	9991	.0	.0
2504.1	48	5	43	233	151	82	9901	9991	.0	.0
2505.1	48	5	43	233	151	82	9901	9991	.0	.0
2506.1	48	5	43	233	151	82	9901	9991	.0	.0
2507.2	48	5	43	233	151	82	9901	9991	.0	.0
2508.2	48	5	43	233	151	82	9901	9991	.0	.0
2509.2	48	5	43	233	151	82	9901	9991	.0	.0
2510.2	48	5	43	233	151	82	9901	9991	.0	.0
2511.3	48	5	43	233	151	82	9901	9991	.0	.0
2512.3	48	5	43	233	151	82	9901	9991	.0	.0
2513.3	48	5	43	233	151	82	9901	9991	.0	.0
2514.3	48	5	43	233	151	82	9901	9991	.0	.0
2515.4	48	5	43	233	151	82	9901	9991	.0	.0
2516.4	48	5	43	233	151	82	9901	9991	.0	.0
2517.4	48	5	43	233	151	82	9901	9991	.0	.0
2518.4	48	5	43	233	151	82	9901	9991	.0	.0

LRV--3

TIME SEC.	R+ CNTS	R- CNTS	TOTAL R CNTS	B+ CNTS	B- CNTS	TOTAL B CNTS	ORF CNTS	OLR CNTS	SPEED-RF KM/HR.	SPEED-L KM/HR.
2519.4	48	5	43	233	151	82	9901	9991	.0	.0
2520.5	48	5	43	233	151	82	9901	9991	.0	.0
2521.5	48	5	43	233	151	82	9901	9991	.0	.0
2522.5	48	5	43	233	151	82	9901	9991	.0	.0
2523.5	48	5	43	233	151	82	9901	9991	.0	.0
2524.6	48	5	43	233	151	82	9901	9991	.0	.0
2525.6	48	5	43	233	151	82	9901	9991	.0	.0
2526.6	48	5	43	233	151	82	9901	9991	.0	.0
2527.6	48	5	43	233	151	82	9901	9991	.0	.0
2528.7	48	5	43	233	151	82	9901	9991	.0	.0
2529.7	48	5	43	233	151	82	9901	9991	.0	.0
2530.7	48	5	43	233	151	82	9901	9991	.0	.0
2531.7	48	5	43	233	151	82	9901	9991	.0	.0
2532.8	48	5	43	233	151	82	9901	9991	.0	.0
2533.8	48	5	43	233	151	82	9901	9991	.0	.0
2534.8	48	5	43	233	151	82	9901	9991	.0	.0
2535.8	48	5	43	233	151	82	9901	9991	.0	.0
2536.9	48	5	43	233	151	82	9901	9991	.0	.0
2537.9	48	5	43	233	151	82	9901	9991	.0	.0
2538.9	48	5	43	233	151	82	9901	9991	.0	.0
2539.9	48	5	43	233	151	82	9901	9991	.0	.0
2540.9	48	5	43	233	151	82	9901	9991	.0	.0
2542.0	48	5	43	233	151	82	9901	9991	.0	.0
2543.0	48	5	43	233	151	82	9901	9991	.0	.0
2544.0	48	5	43	233	151	82	9901	9991	.0	.0
2545.0	48	5	43	233	151	82	9901	9991	.0	.0
2546.1	48	5	43	233	151	82	9901	9991	.0	.0
2547.1	48	5	43	233	151	82	9901	9991	.0	.0
2548.1	48	5	43	233	151	82	9901	9991	.0	.0
2549.1	48	5	43	233	151	82	9901	9991	.0	.0
2550.2	48	5	43	233	151	82	9901	9991	.0	.0
2551.2	48	5	43	233	151	82	9901	9991	.0	.0
2552.2	48	5	43	233	151	82	9901	9991	.0	.0
2553.2	48	5	43	233	151	82	9901	9991	.0	.0
2554.3	48	5	43	233	151	82	9901	9991	.0	.0
2555.3	48	5	43	233	151	82	9901	9991	.0	.0
2556.3	48	5	43	233	151	82	9901	9991	.0	.0
2557.3	48	5	43	233	151	82	9901	9991	.0	.0
2558.4	48	5	43	233	151	82	9901	9991	.0	.0
2559.4	48	5	43	233	151	82	9901	9991	.0	.0
2560.4	48	5	43	233	151	82	9901	9991	.0	.0
2561.4	48	5	43	233	151	82	9901	9991	.0	.0
2562.4	48	5	43	233	151	82	9901	9991	.0	.0
2563.5	48	5	43	233	151	82	9901	9991	.0	.0
2564.5	48	5	43	233	151	82	9901	9991	.0	.0
2565.5	48	5	43	233	151	82	9901	9991	.0	.0
2566.5	48	5	43	233	151	82	9901	9991	.0	.0
2567.6	48	5	43	233	151	82	9901	9991	.0	.0
2568.6	48	5	43	233	151	82	9901	9991	.0	.0
2569.6	48	5	43	233	151	82	9901	9991	.0	.0
2570.6	48	5	43	233	151	82	9901	9991	.0	.0
2571.7	48	5	43	233	151	82	9901	9991	.0	.0
2572.7	48	5	43	233	151	82	9901	9991	.0	.0
2573.7	48	5	43	233	151	82	9901	9991	.0	.0
2574.7	48	5	43	233	151	82	9901	9991	.0	.0
2575.8	48	5	43	233	151	82	9901	9991	.0	.0
2576.8	48	5	43	233	151	82	9902	9991	1.7	.0
2577.8	48	5	43	233	151	82	9904	9992	3.4	1.7
2578.8	48	5	43	233	151	82	9906	9994	3.4	3.4
2579.9	48	5	43	233	151	82	9909	9996	5.1	3.4

TIME SEC.	R+ CNTS	R- CNTS	TOTAL R CNTS	L+ CNTS	B- CNTS	TOTAL B CNTS	ORT CNTS	OLR CNTS	SPEED-RT KM/HR.	SPEED-LT KM/HR.
2580.9	48	5	43	233	151	82	9911	9998	3.4	3.4
2581.9	48	5	43	233	151	82	9914	10000	3.4	3.4
2582.9	48	5	43	233	151	82	9917	10002	3.4	3.4
2583.9	48	5	43	233	151	82	9920	10004	3.4	3.4
2585.0	48	5	43	234	151	83	9923	10007	3.4	3.4
2586.0	48	5	43	234	152	82	9926	10009	3.4	3.4
2587.0	48	5	43	234	152	82	9929	10012	3.4	3.4
2588.0	48	5	43	234	152	82	9932	10015	3.4	3.4
2589.1	48	5	43	234	152	82	9935	10018	3.4	3.4
2590.1	48	5	43	234	152	82	9938	10022	3.4	6.8
2591.1	48	5	43	234	152	82	9942	10026	6.8	6.8
2592.1	48	5	43	234	152	82	9946	10030	6.8	6.8
2593.2	48	5	43	234	152	82	9950	10034	6.8	6.8
2594.2	48	5	43	234	152	82	9955	10040	8.6	10.3
2595.2	49	5	44	234	152	82	9961	10046	10.3	10.3
2596.2	49	5	44	234	152	82	9966	10051	8.6	8.6
2597.3	49	5	44	234	152	82	9971	10056	8.6	8.6
2598.3	49	5	44	234	152	82	9977	10061	10.3	8.6
2599.3	49	5	44	234	152	82	9982	10066	8.6	8.6
2600.3	49	5	44	234	152	82	9988	10072	10.3	10.3
2601.3	49	5	44	234	152	82	9994	10078	10.3	10.3
2602.4	49	5	44	234	152	82	9999	10084	8.6	8.3
2603.4	49	5	44	234	152	82	10003	10089	6.8	8.6
2604.4	49	5	44	234	152	82	10007	10094	6.8	8.6
2605.4	49	5	44	234	152	82	10011	10098	6.8	6.8
2606.5	49	5	44	234	152	82	10015	10102	6.8	6.8
2607.5	49	5	44	234	152	82	10019	10106	6.8	6.8
2608.5	49	5	44	234	152	82	10022	10110	5.1	6.8
2609.5	49	5	44	234	152	82	10027	10114	8.6	6.8
2610.6	49	5	44	234	152	82	10032	10119	8.6	8.6
2611.6	49	5	44	234	152	82	10037	10123	8.6	6.8
2612.6	49	5	44	234	152	82	10042	10129	8.6	10.3
2613.6	49	5	44	234	152	82	10047	10134	8.6	8.6
2614.7	49	5	44	234	152	82	10053	10140	10.3	10.3
2615.7	49	5	44	234	152	82	10058	10145	8.6	8.6
2616.7	49	5	44	234	152	82	10064	10151	10.3	10.3
2617.7	49	5	44	234	152	82	10069	10156	8.6	8.6
2618.8	49	5	44	234	152	82	10075	10162	10.3	10.3
2619.8	49	5	44	234	152	82	10080	10168	8.6	10.3
2620.8	49	5	44	234	152	82	10086	10173	10.3	8.6
2621.8	49	5	44	234	152	82	10091	10179	8.6	10.3
2622.8	49	5	44	234	152	82	10098	10186	12.0	12.0
2623.9	49	5	44	234	152	82	10104	10192	10.3	10.3
2624.9	49	5	44	234	152	82	10110	10198	10.3	10.3
2625.9	49	5	44	234	152	82	10116	10204	10.3	10.3
2626.9	49	5	44	234	152	82	10122	10210	10.3	10.3
2628.0	49	5	44	234	152	82	10128	10216	10.3	10.3
2629.0	49	5	44	234	152	82	10134	10222	10.3	10.3
2630.0	49	5	44	234	152	82	10140	10229	10.3	12.0
2631.0	49	5	44	234	152	82	10147	10235	12.0	10.3
2632.1	49	5	44	234	152	82	10153	10241	10.3	10.3
2633.1	49	5	44	234	152	82	10159	10247	10.3	10.3
2634.1	49	5	44	234	152	82	10164	10252	8.6	8.6
2635.1	49	5	44	234	152	82	10169	10257	8.6	8.6
2636.2	49	5	44	234	152	82	10175	10260	10.3	5.1
2637.2	50	5	45	234	152	82	10179	10263	6.8	5.1
2638.2	50	5	45	234	152	82	10183	10266	6.8	5.1
2639.2	50	5	45	234	152	82	10187	10269	6.8	5.1
2640.3	50	5	45	234	152	82	10191	10272	6.8	5.1
2641.3	50	5	45	234	152	82	10195	10276	6.8	6.8

TIME SEC.	R+ CNTS	R- CNTS	TOTAL R CNTS	B+ CNTS	B- CNTS	TOTAL B CNTS	ORB CNTS	GLR CNTS	SPEED-RF KM/HR.	SPEED-I KM/HR.
2642.3	50	5	45	234	152	82	10199	10280	6.6	6.6
2643.3	50	5	45	234	152	82	10204	10287	6.6	6.6
2644.3	50	5	45	234	152	82	10208	10289	6.8	6.6
2645.4	50	5	45	234	152	82	10212	10293	6.8	6.6
2646.4	50	5	45	234	152	82	10216	10297	6.8	6.6
2647.4	50	5	45	234	152	82	10219	10301	8.1	6.6
2648.4	50	5	45	234	152	82	10222	10305	8.1	6.6
2649.5	50	5	45	234	152	82	10224	10308	8.4	8.1
2650.5	50	5	45	234	152	82	10227	10311	8.1	8.1
2651.5	50	5	45	234	152	82	10231	10315	6.8	6.8
2652.5	50	5	45	234	152	82	10235	10320	6.8	6.6
2653.6	50	5	45	234	152	82	10239	10325	6.8	6.6
2654.6	50	5	45	234	152	82	10244	10330	8.6	6.6
2655.6	50	5	45	234	152	82	10249	10336	8.6	10.3
2656.6	50	5	45	234	152	82	10255	10342	10.3	10.3
2657.7	50	5	45	234	152	82	10261	10348	10.3	10.3
2658.7	50	5	45	234	152	82	10267	10354	10.3	10.3
2659.7	50	5	45	234	152	82	10273	10360	10.3	10.3
2660.7	50	5	45	234	152	82	10279	10366	10.3	10.3
2661.8	50	5	45	234	152	82	10286	10373	12.0	12.0
2662.8	50	5	45	234	152	82	10292	10379	10.3	10.3
2663.8	50	5	45	234	152	82	10297	10385	8.6	10.3
2664.8	50	5	45	234	152	82	10303	10391	10.3	10.3
2665.8	50	5	45	234	152	82	10310	10397	12.0	10.3
2666.9	50	5	45	234	153	81	10316	10403	10.3	10.3
2667.9	50	5	45	235	153	82	10322	10409	10.3	10.3
2668.9	50	5	45	235	154	81	10328	10415	10.3	10.3
2669.9	50	5	45	235	154	81	10334	10422	10.3	12.0
2671.0	50	5	45	235	154	81	10340	10428	10.3	10.3
2672.0	50	5	45	235	154	81	10345	10435	8.6	12.0
2673.0	50	5	45	235	154	81	10350	10441	8.6	10.3
2674.0	50	5	45	235	154	81	10354	10446	6.8	8.6
2675.1	50	5	45	235	154	81	10359	10450	8.6	6.8
2676.1	50	5	45	235	154	81	10363	10454	6.8	6.8
2677.1	50	5	45	235	154	81	10368	10458	8.6	6.8
2678.1	50	5	45	235	154	81	10372	10463	6.8	8.6
2679.2	50	5	45	235	154	81	10377	10468	8.6	8.6
2680.2	50	5	45	235	154	81	10382	10473	8.6	8.6
2681.2	50	5	45	235	154	81	10387	10478	8.6	8.6
2682.2	50	5	45	235	154	81	10393	10484	10.3	10.3
2683.2	50	5	45	235	154	81	10399	10491	10.3	12.0
2684.3	50	5	45	236	154	82	10405	10497	10.3	10.3
2685.3	50	5	45	236	155	81	10410	10502	8.6	8.6
2686.3	50	5	45	237	155	82	10416	10509	10.3	12.0
2687.3	50	5	45	237	156	81	10422	10514	10.3	8.6
2688.4	50	5	45	238	156	82	10427	10520	8.6	10.3
2689.4	51	5	46	238	156	82	10433	10525	10.3	8.6
2690.4	51	5	46	238	156	82	10438	10530	8.6	8.6
2691.4	51	5	46	238	156	82	10443	10536	8.6	10.3
2692.5	51	5	46	238	156	82	10448	10541	8.6	8.6
2693.5	51	5	46	238	156	82	10452	10545	6.8	6.8
2694.5	51	5	46	238	156	82	10456	10549	6.8	6.8
2695.5	51	5	46	238	156	82	10461	10554	8.6	8.6
2696.6	51	5	46	238	156	82	10465	10558	6.8	6.8
2697.6	51	5	46	238	156	82	10470	10563	8.6	8.6
2698.6	51	5	46	238	156	82	10475	10568	8.6	8.6
2699.6	51	5	46	238	156	82	10479	10572	6.8	6.8
2700.7	51	5	46	238	156	82	10484	10577	8.6	8.6
2701.7	51	5	46	238	156	82	10489	10581	8.6	6.8
2702.7	51	5	46	238	156	82	10494	10585	8.6	6.8

TIME SEC.	R+ CNTS	R- CNTS	TOTAL R CNTS	L+ CNTS	L- CNTS	TOTAL L CNTS	ORT CNTS	GLR CNTS	SPEED-RF KM/HR.	SPEED-LF KM/HR.
2703.7	51	5	46	238	156	82	10499	10589	6.6	6.6
2704.7	51	5	46	238	156	82	10503	10594	6.8	6.6
2705.6	51	5	46	238	156	82	10507	10598	6.6	6.6
2706.6	51	5	46	238	156	82	10510	10602	6.1	6.6
2707.8	51	5	46	238	156	82	10514	10607	6.8	6.8
2708.8	51	5	46	238	156	82	10519	10611	6.6	6.6
2709.9	51	5	46	238	156	82	10524	10616	6.6	6.6
2710.9	51	5	46	238	156	82	10529	10621	6.6	6.6
2711.9	51	5	46	238	156	82	10534	10626	6.6	6.6
2712.9	51	5	46	238	156	82	10539	10632	6.6	6.6
2714.0	51	5	46	238	156	82	10540	10628	10.3	10.3
2715.0	51	5	46	238	156	82	10551	10643	10.3	10.3
2716.0	52	5	46	238	156	82	10557	10649	10.3	6.6
2717.0	51	5	46	238	156	82	10563	10655	10.3	10.3
2718.1	51	5	46	238	156	82	10570	10662	12.0	10.3
2719.1	51	5	46	238	156	82	10576	10667	10.3	12.0
2720.1	51	5	46	238	156	82	10582	10674	10.3	10.3
2721.1	51	5	46	238	156	82	10588	10680	10.3	12.0
2722.2	51	5	46	238	156	82	10593	10686	8.6	10.3
2723.2	51	5	46	238	156	82	10599	10693	10.3	10.3
2724.2	51	5	46	238	156	82	10605	10699	10.3	12.0
2725.2	51	5	46	238	156	82	10610	10705	8.6	10.3
2726.2	51	5	46	238	156	82	10615	10711	8.6	10.3
2727.3	51	5	46	238	156	82	10621	10716	10.3	8.6
2728.3	51	5	46	238	156	82	10626	10720	8.6	6.8
2729.3	51	5	46	238	156	82	10631	10724	8.6	6.8
2730.3	51	5	46	238	156	82	10637	10729	10.3	8.6
2731.4	51	5	46	238	156	82	10642	10735	8.6	10.3
2732.4	51	5	46	238	156	82	10647	10740	8.6	8.6
2733.4	51	5	46	238	156	82	10652	10746	8.6	10.3
2734.4	52	5	47	238	156	82	10657	10751	8.6	8.6
2735.5	52	5	47	238	156	82	10662	10756	8.6	8.6
2736.5	52	5	47	238	156	82	10667	10761	8.6	8.6
2737.5	52	5	47	238	156	82	10671	10766	6.8	8.6
2738.5	52	5	47	238	156	82	10675	10770	6.8	8.6
2739.6	52	5	47	238	156	82	10679	10775	6.8	8.6
2740.6	52	5	47	238	156	82	10683	10779	6.8	6.8
2741.6	52	5	47	238	156	82	10686	10782	5.1	5.1
2742.6	52	5	47	238	156	82	10689	10785	5.1	5.1
2743.7	52	5	47	238	156	82	10692	10788	5.1	5.1
2744.7	52	5	47	238	156	82	10694	10791	3.4	5.1
2745.7	52	5	47	238	156	82	10697	10793	5.1	3.4
2746.7	52	5	47	238	156	82	10701	10797	6.8	6.8
2747.7	52	5	47	238	156	82	10705	10802	6.8	8.6
2748.8	52	5	47	238	156	82	10710	10807	8.6	8.6
2749.8	52	5	47	238	156	82	10716	10812	10.3	8.6
2750.8	52	5	47	238	156	82	10721	10818	8.6	10.3
2751.8	52	5	47	238	156	82	10727	10824	10.3	10.3
2752.9	52	5	47	238	156	82	10733	10830	10.3	10.3
2753.9	52	5	47	238	156	82	10739	10836	10.3	10.3
2754.9	52	5	47	238	156	82	10745	10842	10.3	10.3
2755.9	52	5	47	238	156	82	10750	10848	8.6	10.3
2757.0	52	5	47	238	156	82	10756	10853	10.3	8.6
2758.0	52	5	47	238	156	82	10761	10859	8.6	10.3
2759.0	52	5	47	238	156	82	10767	10865	10.3	10.3
2760.0	52	5	47	238	156	82	10772	10871	8.6	10.3
2761.1	52	5	47	238	156	82	10778	10877	10.3	10.3
2762.1	52	5	47	238	156	82	10784	10883	10.3	10.3
2763.1	52	5	47	238	156	82	10789	10888	8.6	8.6
2764.1	52	5	47	238	156	82	10794	10893	8.6	8.6

TIME SEC.	R+ CNTS	R- CNTS	TOTAL R CNTS	L+ CNTS	L- CNTS	TOTAL L CNTS	ORF CNTS	OLR CNTS	SPEED-RF KM/HR.	SPEED-LR KM/HR.
2765.1	52	5	47	238	157	81	10800	10899	10.3	10.3
2766.2	52	5	47	238	157	81	10805	10904	8.6	8.6
2767.2	52	5	47	239	157	82	10810	10910	8.6	10.3
2768.2	52	5	47	239	157	82	10816	10916	10.3	10.3
2769.2	52	5	47	239	157	82	10822	10922	10.3	10.3
2770.3	52	5	47	239	157	82	10828	10928	10.3	10.3
2771.3	52	5	47	239	157	82	10834	10934	10.3	10.3
2772.3	52	5	47	239	157	82	10839	10939	8.6	8.6
2773.3	52	5	47	239	157	82	10845	10943	10.3	6.8
2774.4	52	5	47	239	157	82	10850	10948	8.6	8.6
2775.4	52	5	47	239	158	81	10854	10953	6.8	8.6
2776.4	52	5	47	239	158	81	10859	10958	8.6	8.6
2777.4	53	5	48	239	158	81	10864	10963	8.6	8.6
2778.5	53	5	48	239	158	81	10868	10967	6.8	6.8
2779.5	53	5	48	239	158	81	10873	10972	8.6	8.6
2780.5	53	5	48	239	158	81	10878	10978	8.6	10.3
2781.5	53	5	48	239	158	81	10884	10983	10.3	8.6
2782.6	53	5	48	239	158	81	10890	10989	10.3	10.3
2783.6	53	5	48	239	158	81	10895	10995	8.6	10.3
2784.6	53	5	48	239	158	81	10900	11001	8.6	10.3
2785.6	53	5	48	239	158	81	10905	11006	8.6	8.6
2786.6	53	5	48	239	158	81	10909	11011	6.8	8.6
2787.7	53	5	48	239	158	81	10914	11016	8.6	8.6
2788.7	53	5	48	239	158	81	10918	11021	6.8	8.6
2789.7	53	5	48	239	158	81	10923	11027	8.6	10.3
2790.7	53	5	48	239	158	81	10929	11032	10.3	8.6
2791.8	53	5	48	239	158	81	10934	11037	8.6	8.6
2792.8	53	5	48	239	158	81	10940	11043	10.3	10.3
2793.8	53	5	48	239	158	81	10946	11049	10.3	10.3
2794.8	53	5	48	239	158	81	10952	11055	10.3	10.3
2795.9	53	5	48	239	158	81	10958	11061	10.3	10.3
2796.9	53	5	48	239	158	81	10964	11066	10.3	8.6
2797.9	53	5	48	239	158	81	10969	11072	8.6	10.3
2798.9	53	5	48	239	158	81	10975	11078	10.3	10.3
2800.0	53	5	48	239	158	81	10981	11083	10.3	8.6
2801.0	53	5	48	239	158	81	10986	11089	8.6	10.3
2802.0	53	5	48	239	158	81	10992	11095	10.3	10.3
2803.0	53	5	48	239	158	81	10997	11101	8.6	10.3
2804.1	53	5	48	239	158	81	11003	11107	10.3	10.3
2805.1	53	5	48	239	158	81	11009	11113	10.3	10.3
2806.1	53	5	48	239	158	81	11014	11119	8.6	10.3
2807.1	53	5	48	239	158	81	11020	11125	10.3	10.3
2808.1	53	5	48	239	158	81	11026	11131	10.3	10.3
2809.2	53	5	48	239	158	81	11032	11137	10.3	10.3
2810.2	53	5	48	239	158	81	11037	11142	8.6	8.6
2811.2	53	5	48	239	158	81	11042	11147	8.6	8.6
2812.2	53	5	48	239	158	81	11047	11152	8.6	8.6
2813.3	53	5	48	239	158	81	11052	11157	8.6	8.6
2814.3	53	5	48	239	158	81	11057	11161	8.6	6.8
2815.3	53	5	48	239	158	81	11062	11167	8.6	10.3
2816.3	53	5	48	239	158	81	11067	11172	8.6	8.6
2817.4	54	5	49	239	158	81	11072	11178	8.6	10.3
2818.4	54	5	49	239	158	81	11077	11183	8.6	8.6
2819.4	54	5	49	239	158	81	11083	11189	10.3	10.3
2820.4	54	5	49	239	158	81	11089	11195	10.3	10.3
2821.5	54	5	49	239	158	81	11095	11201	10.3	10.3
2822.5	54	5	49	239	158	81	11100	11208	8.6	12.0
2823.5	54	5	49	239	158	81	11106	11213	10.3	8.6
2824.5	54	5	49	239	158	81	11111	11219	8.6	10.3
2825.6	54	5	49	239	158	81	11117	11225	10.3	10.3

TIME SEC.	R+ CNTS	R- CNTS	TOTAL R CNTS	B+ CNTS	B- CNTS	TOTAL B CNTS	ORF CNTS	OLR CNTS	SPEED-RF KM/HR.	SPEED-LF KM/HR.
2826.6	54	5	49	239	158	81	11122	11230	8.6	8.6
2827.6	54	5	49	239	158	81	11128	11235	10.3	8.6
2828.6	54	5	49	239	158	81	11133	11241	8.6	10.3
2829.6	54	5	49	239	158	81	11138	11247	8.6	10.3
2830.7	54	5	49	239	158	81	11144	11251	10.3	8.6
2831.7	54	5	49	239	158	81	11149	11255	8.6	8.6
2832.7	54	5	49	239	158	81	11154	11259	8.6	8.6
2833.7	54	5	49	239	158	81	11158	11264	8.6	8.6
2834.8	54	5	49	239	158	81	11162	11268	8.6	8.6
2835.8	54	5	49	239	158	81	11166	11273	8.6	8.6
2836.8	54	5	49	240	158	82	11171	11278	8.6	8.6
2837.8	54	5	49	240	158	82	11175	11283	8.6	8.6
2838.9	54	5	49	240	158	82	11179	11288	8.6	8.6
2839.9	54	5	49	240	158	82	11184	11293	8.6	8.6
2840.9	54	5	49	240	158	82	11189	11298	8.6	8.6
2841.9	54	5	49	240	158	82	11195	11303	10.3	8.6
2843.0	54	5	49	240	158	82	11201	11310	10.3	12.0
2844.0	54	5	49	240	158	82	11207	11316	10.3	10.3
2845.0	54	5	49	240	158	82	11213	11322	10.3	10.3
2846.0	54	5	49	240	158	82	11220	11329	12.0	12.0
2847.0	54	5	49	240	158	82	11226	11335	10.3	10.3
2848.1	54	5	49	240	158	82	11232	11341	10.3	10.3
2849.1	54	5	49	240	158	82	11238	11347	10.3	10.3
2850.1	54	5	49	240	158	82	11245	11354	12.0	12.0
2851.1	54	5	49	240	158	82	11251	11360	10.3	10.3
2852.2	54	5	49	240	158	82	11257	11367	10.3	12.0
2853.2	54	5	49	240	158	82	11264	11373	12.0	10.3
2854.2	54	5	49	240	158	82	11270	11380	10.3	12.0
2855.2	54	5	49	240	158	82	11276	11387	10.3	10.3
2856.3	54	5	49	240	158	82	11283	11393	12.0	10.3
2857.3	54	5	49	240	158	82	11289	11400	10.3	12.0
2858.3	55	5	50	240	158	82	11295	11406	10.3	10.3
2859.3	55	5	50	240	158	82	11302	11412	12.0	10.3
2860.4	55	5	50	240	158	82	11308	11419	10.3	12.0
2861.4	55	5	50	240	158	82	11314	11425	10.3	10.3
2862.4	55	5	50	240	159	81	11320	11431	10.3	10.3
2863.4	55	5	50	240	159	81	11326	11437	10.3	10.3
2864.5	55	5	50	240	159	81	11332	11443	10.3	10.3
2865.5	55	5	50	240	159	81	11338	11449	10.3	10.3
2866.5	55	5	50	240	159	81	11344	11455	10.3	10.3
2867.5	55	5	50	240	159	81	11350	11461	12.0	10.3
2868.5	55	5	50	240	159	81	11357	11466	10.3	8.6
2869.6	55	5	50	240	159	81	11362	11471	8.6	8.6
2870.6	55	5	50	240	159	81	11367	11476	8.6	8.6
2871.6	55	5	50	240	159	81	11372	11481	8.6	8.6
2872.6	55	5	50	240	159	81	11377	11486	8.6	8.6
2873.7	55	5	50	240	159	81	11382	11491	8.6	8.6
2874.7	55	5	50	240	159	81	11387	11497	8.6	10.3
2875.7	55	5	50	240	159	81	11393	11503	10.3	10.3
2876.7	55	5	50	240	159	81	11398	11509	8.6	10.3
2877.8	55	5	50	240	159	81	11403	11514	8.6	8.6
2878.8	55	5	50	240	159	81	11408	11519	8.6	8.6
2879.8	55	5	50	240	159	81	11413	11524	8.6	8.6
2880.8	55	5	50	240	159	81	11418	11529	8.6	8.6
2881.9	55	5	50	240	159	81	11424	11535	10.3	10.3
2882.9	55	5	50	240	159	81	11429	11540	8.6	8.6
2883.9	55	5	50	240	159	81	11435	11546	10.3	10.3
2884.9	55	5	50	240	159	81	11441	11552	10.3	10.3
2886.0	55	5	50	240	159	81	11447	11558	10.3	10.3
2887.0	55	5	50	240	159	81	11453	11564	10.3	10.3

TIME SEC.	R+ CNTS	R- CNTS	TOTAL R CNTS	B+ CNTS	B- CNTS	TOTAL B CNTS	ORT CNTS	OLR CNTS	SPEED-RT KM/HR.	SPEED-LT KM/HR.
2888.0	55	5	50	240	159	81	11459	11579	10.3	10.3
2889.0	55	5	50	240	159	81	11465	11577	10.3	12.0
2890.0	55	5	50	240	159	81	11472	11583	12.0	10.3
2891.1	55	5	50	240	159	81	11478	11589	10.3	10.3
2892.1	55	5	50	240	159	81	11485	11595	12.0	10.3
2893.1	55	5	50	240	159	81	11491	11601	10.3	10.3
2894.1	55	5	50	240	159	81	11497	11606	10.3	8.6
2895.2	56	6	50	241	159	82	11503	11612	10.3	10.3
2896.2	57	6	51	241	159	82	11509	11618	10.3	10.3
2897.2	57	6	51	241	159	82	11515	11624	10.3	10.3
2898.2	57	6	51	241	159	82	11521	11630	10.3	10.3
2899.3	57	6	51	241	159	82	11527	11637	10.3	12.0
2900.3	57	6	51	241	159	82	11533	11643	10.3	8.6
2901.3	57	6	51	241	159	82	11539	11649	10.3	10.3
2902.3	57	6	51	241	159	82	11545	11655	10.3	10.3
2903.4	57	6	51	241	159	82	11551	11662	10.3	12.0
2904.4	57	6	51	241	159	82	11558	11669	12.0	12.0
2905.4	57	6	51	241	159	82	11563	11675	8.6	10.3
2906.4	57	6	51	241	159	82	11570	11682	12.0	12.0
2907.5	57	6	51	241	159	82	11576	11689	10.3	12.0
2908.5	57	6	51	241	159	82	11583	11696	12.0	12.0
2909.5	57	6	51	241	159	82	11589	11701	10.3	8.6
2910.5	57	6	51	241	159	82	11595	11707	10.3	10.3
2911.5	57	6	51	241	159	82	11599	11712	8.6	8.6
2912.6	57	6	51	241	159	82	11603	11718	8.6	10.3
2913.6	57	6	51	241	159	82	11608	11723	8.6	8.6
2914.6	57	6	51	241	159	82	11612	11728	8.6	8.6
2915.7	57	6	51	241	159	82	11618	11734	10.3	8.6
2916.7	57	6	51	241	159	82	11623	11739	8.6	8.6
2917.7	57	6	51	241	159	82	11628	11743	8.6	8.6
2918.7	57	6	51	241	159	82	11632	11748	8.6	8.6
2919.7	57	6	51	241	159	82	11637	11753	8.6	8.6
2920.8	57	6	51	241	159	82	11642	11758	8.6	8.6
2921.8	57	6	51	241	159	82	11647	11763	8.6	8.6
2922.8	57	6	51	241	159	82	11653	11769	10.3	10.3
2923.8	57	6	51	241	159	82	11658	11774	8.6	8.6
2924.9	57	6	51	241	159	82	11664	11780	10.3	10.3
2925.9	57	6	51	241	159	82	11669	11786	8.6	10.3
2926.9	57	6	51	241	159	82	11675	11791	10.3	8.6
2927.9	57	6	51	241	159	82	11680	11797	8.6	10.3
2928.9	57	6	51	241	159	82	11685	11802	8.6	8.6
2930.0	57	6	51	241	159	82	11691	11808	10.3	10.3
2931.0	57	6	51	241	159	82	11696	11813	8.6	8.6
2932.0	57	6	51	241	159	82	11701	11819	8.6	10.3
2933.0	57	6	51	241	159	82	11706	11824	8.6	8.6
2934.1	57	6	51	241	159	82	11711	11829	8.6	8.6
2935.1	57	6	51	241	159	82	11716	11835	8.6	10.3
2936.1	58	6	52	241	159	82	11722	11840	10.3	8.6
2937.1	58	6	52	241	159	82	11727	11846	8.6	10.3
2938.2	58	6	52	241	159	82	11732	11852	8.6	10.3
2939.2	58	6	52	241	159	82	11738	11857	10.3	8.6
2940.2	58	6	52	241	159	82	11743	11863	8.6	10.3
2941.2	58	6	52	241	159	82	11748	11869	8.6	10.3
2942.3	58	6	52	241	159	82	11754	11874	10.3	8.6
2943.3	58	6	52	241	159	82	11759	11878	8.6	8.6
2944.3	58	6	52	241	159	82	11764	11883	8.6	8.6
2945.3	58	6	52	241	159	82	11769	11888	8.6	8.6
2946.4	58	6	52	241	159	82	11774	11893	8.6	8.6
2947.4	58	6	52	241	159	82	11779	11899	8.6	10.3
2948.4	58	6	52	241	159	82	11784	11904	8.6	8.6

TIME SEC.	R+ CNTS	R- CNTS	TOTAL R CNTS	L+ CNTS	L- CNTS	TOTAL B CNTS	ORF CNTS	OLR CNTS	SPEED-OF KM/HR.	SPEED-OF KM/HR.
2949.4	58	6	52	241	159	82	11788	11909	6.8	8.6
2950.4	58	6	52	241	159	82	11792	11914	6.8	8.6
2951.5	58	6	52	241	159	82	11796	11917	6.8	5.1
2952.5	58	6	52	241	159	82	11800	11921	6.8	6.8
2953.5	58	6	52	241	159	82	11805	11925	8.6	6.8
2954.5	58	6	52	241	159	82	11809	11929	6.8	6.8
2955.6	58	6	52	241	159	82	11814	11933	8.6	6.8
2956.6	58	6	52	241	159	82	11818	11938	6.8	8.6
2957.6	58	6	52	241	159	82	11823	11943	8.6	8.6
2958.6	58	6	52	241	159	82	11828	11949	8.6	10.3
2959.7	58	6	52	241	159	82	11833	11954	8.6	8.6
2960.7	58	6	52	241	159	82	11837	11959	6.8	8.6
2961.7	58	6	52	241	159	82	11841	11964	6.8	8.6
2962.7	58	6	52	241	159	82	11846	11969	8.6	8.6
2963.8	58	6	52	241	159	82	11850	11973	6.8	8.6
2964.8	58	6	52	241	159	82	11855	11978	8.6	8.6
2965.8	58	6	52	241	159	82	11859	11982	6.8	8.6
2966.8	58	6	52	241	159	82	11864	11987	8.6	8.6
2967.9	58	6	52	241	159	82	11869	11992	8.6	8.6
2968.9	58	6	52	241	159	82	11874	11997	8.6	8.6
2969.9	58	6	52	241	159	82	11879	12002	8.6	8.6
2970.9	58	6	52	241	159	82	11884	12007	8.6	8.6
2971.9	58	6	52	241	159	82	11890	12013	10.3	10.3
2973.0	58	6	52	241	159	82	11894	12017	6.8	6.8
2974.0	58	6	52	241	159	82	11898	12021	6.8	6.8
2975.0	58	6	52	241	159	82	11902	12025	6.8	6.8
2976.0	58	6	52	241	159	82	11905	12028	5.1	5.1
2977.1	58	6	52	241	159	82	11908	12031	5.1	5.1
2978.1	58	6	52	241	159	82	11911	12034	5.1	5.1
2979.1	58	6	52	241	159	82	11914	12037	5.1	5.1
2980.1	58	6	52	241	159	82	11918	12041	6.8	6.8
2981.2	58	6	52	241	159	82	11921	12045	5.1	6.8
2982.2	58	6	52	241	159	82	11925	12049	6.8	6.8
2983.2	58	6	52	241	159	82	11929	12052	6.8	5.1
2984.2	58	6	52	241	159	82	11933	12056	6.8	6.8
2985.3	59	6	53	241	159	82	11937	12060	6.8	6.8
2986.3	59	6	53	241	159	82	11940	12064	5.1	6.8
2987.3	59	6	53	241	159	82	11945	12069	8.6	8.6
2988.3	59	6	53	241	159	82	11949	12073	6.8	6.8
2989.4	59	6	53	241	159	82	11953	12077	6.8	6.8
2990.4	59	6	53	241	159	82	11957	12081	6.8	6.8
2991.4	59	6	53	241	159	82	11962	12086	8.6	8.6
2992.4	59	6	53	241	159	82	11968	12092	10.3	10.3
2993.4	59	6	53	241	159	82	11974	12098	10.3	10.3
2994.5	59	6	53	241	159	82	11980	12105	10.3	12.0
2995.5	59	6	53	241	159	82	11986	12111	10.3	10.3
2996.5	59	6	53	241	159	82	11992	12117	10.3	10.3
2997.5	59	6	53	241	159	82	11998	12123	10.3	10.3
2998.6	59	6	53	241	159	82	12004	12130	10.3	12.0
2999.6	59	6	53	241	159	82	12010	12136	10.3	10.3
3000.6	59	6	53	241	159	82	12016	12142	10.3	10.3
3001.6	59	6	53	241	159	82	12022	12148	10.3	10.3
3002.7	59	6	53	241	159	82	12028	12154	10.3	10.3
3003.7	59	6	53	241	159	82	12034	12160	10.3	10.3
3004.7	59	6	53	241	159	82	12040	12166	10.3	10.3
3005.7	59	6	53	241	159	82	12046	12173	10.3	12.0
3006.8	59	6	53	241	159	82	12052	12179	10.3	10.3
3007.8	59	6	53	241	159	82	12058	12185	10.3	10.3
3008.8	59	6	53	241	159	82	12065	12192	12.0	12.0
3009.8	59	6	53	241	159	82	12071	12198	10.3	10.3

TIME SEC.	R+ CNTS	R- CNTS	TOTAL R CNTS	L+ CNTS	L- CNTS	TOTAL L CNTS	ORF CNTS	OLR CNTS	SPEED-ST KM/HR.	SPEED-LT KM/HR.
3010.0	59	6	53	241	159	82	12077	12205	10.3	12.0
3011.0	59	6	53	241	159	82	12083	12211	10.3	10.3
3012.0	59	6	53	241	159	82	12088	12217	0.6	10.3
3013.0	59	6	53	241	159	82	12092	12221	0.8	0.6
3014.0	59	6	53	241	159	82	12096	12225	0.8	0.6
3015.0	59	6	53	241	159	82	12101	12230	0.6	0.6
3016.0	59	6	53	241	159	82	12105	12235	0.8	0.6
3017.0	59	6	53	241	159	82	12110	12239	0.6	0.6
3018.0	59	6	53	241	159	82	12115	12245	0.6	10.3
3019.0	59	6	53	241	159	82	12121	12250	10.3	0.6
3020.1	59	6	53	241	159	82	12126	12256	0.6	10.3
3021.1	59	6	53	241	159	82	12132	12261	10.3	0.6
3022.1	59	6	53	241	159	82	12137	12267	0.6	10.3
3023.1	59	6	54	241	159	82	12142	12272	0.6	0.6
3024.2	59	6	54	241	159	82	12147	12277	0.6	0.6
3025.2	59	6	54	241	159	82	12152	12282	0.6	0.6
3026.2	59	6	54	241	159	82	12156	12286	0.8	0.6
3027.2	59	6	54	241	159	82	12161	12291	0.6	0.6
3028.3	59	6	54	241	159	82	12166	12296	0.6	0.6
3029.3	59	6	54	241	159	82	12170	12301	0.8	0.6
3030.3	59	6	54	241	159	82	12176	12306	10.3	0.6
3031.3	59	6	54	241	159	82	12181	12312	1.6	10.3
3032.4	59	6	54	241	159	82	12186	12316	0.6	10.3
3033.4	59	6	54	241	159	82	12192	12323	10.3	0.6
3034.4	59	6	54	241	159	82	12198	12329	10.3	10.3
3035.4	59	6	54	241	159	82	12203	12335	0.6	0.6
3036.4	59	6	54	241	159	82	12209	12341	10.3	10.3
3037.5	59	6	54	241	159	82	12215	12347	10.3	0.6
3038.5	59	6	54	241	159	82	12220	12353	0.6	10.3
3039.5	59	6	54	241	159	82	12226	12358	10.3	0.6
3040.5	59	6	54	241	159	82	12231	12363	0.6	0.6
3041.6	59	6	54	241	159	82	12235	12367	0.8	0.6
3042.6	59	6	54	241	159	82	12240	12372	0.6	0.6
3043.6	59	6	54	241	159	82	12244	12376	0.8	0.6
3044.6	59	6	54	241	159	82	12248	12380	0.8	0.6
3045.7	59	6	54	241	159	82	12252	12384	0.8	0.6
3046.7	59	6	54	241	159	82	12257	12389	0.6	0.6
3047.7	59	6	54	241	159	82	12262	12394	0.6	0.6
3048.7	60	6	54	241	159	82	12267	12399	0.6	0.6
3049.8	60	6	54	241	159	82	12272	12404	0.6	0.6
3050.8	60	6	54	241	159	82	12278	12410	10.3	10.3
3051.8	60	6	54	241	159	82	12283	12416	0.6	10.3
3052.8	60	6	54	241	159	82	12288	12421	0.6	0.6
3053.8	60	6	54	241	159	82	12293	12426	0.6	0.6
3054.9	60	6	54	241	159	82	12298	12431	0.6	0.6
3055.9	60	6	54	241	159	82	12302	12435	0.8	0.6
3056.9	60	6	54	241	159	82	12307	12440	0.6	0.6
3057.9	60	6	54	241	159	82	12311	12444	0.8	0.6
3059.0	60	6	54	241	159	82	12316	12449	0.6	0.6
3060.0	60	6	54	241	159	82	12321	12454	0.6	0.6
3061.0	60	6	54	241	159	82	12326	12459	0.6	0.6
3062.0	60	6	54	241	159	82	12330	12464	0.8	0.6
3063.1	60	6	54	241	159	82	12335	12468	0.6	0.6
3064.1	60	6	54	241	159	82	12339	12472	0.8	0.6
3065.1	60	6	54	241	159	82	12343	12477	0.8	0.6
3066.1	61	6	55	241	159	82	12348	12482	0.6	0.6
3067.2	61	6	55	241	159	82	12353	12487	0.6	0.6
3068.2	61	6	55	241	159	82	12359	12493	10.3	10.3
3069.2	61	6	55	241	159	82	12365	12499	10.3	10.3
3070.2	61	6	55	241	159	82	12370	12504	0.6	0.6
3071.3	61	6	55	241	159	82	12376	12510	10.3	10.3

TIME SEC.	R+ CNTS	R- CNTS	TOTAL R CNTS	L+ CNTS	L- CNTS	TOTAL L CNTS	ORF CNTS	CLR CNTS	SPEED-RF MI/HR.	SPEED-L KM/HR.
3072.3	61	6	55	241	159	82	12375	12509	6.6	10.6
3073.3	61	6	55	241	159	82	12380	12514	6.6	10.6
3074.3	61	6	55	241	159	82	12385	12519	6.6	10.6
3075.3	61	6	55	241	159	82	12388	12523	6.6	10.6
3076.4	61	6	55	241	159	82	12392	12527	6.6	10.6
3077.4	61	6	55	241	159	82	12396	12531	6.6	10.6
3078.4	61	6	55	241	159	82	12400	12535	6.6	10.6
3079.4	61	6	55	241	159	82	12405	12540	6.6	10.6
3080.5	61	6	55	241	159	82	12410	12545	6.6	10.6
3081.5	61	6	55	241	159	82	12416	12551	19.3	10.6
3082.5	61	6	55	241	159	82	12421	12557	6.6	10.6
3083.5	61	6	55	241	159	82	12427	12562	10.3	10.6
3084.6	61	6	55	241	159	82	12432	12568	6.6	10.6
3085.6	61	6	55	241	159	82	12437	12573	6.6	10.6
3086.6	61	6	55	241	159	82	12442	12578	6.6	10.6
3087.6	61	6	55	241	159	82	12447	12583	6.6	10.6
3088.7	61	6	55	241	159	82	12451	12587	6.6	10.6
3089.7	61	6	55	241	159	82	12455	12591	6.6	10.6
3090.7	61	6	55	241	159	82	12459	12595	6.6	10.6
3091.7	61	6	55	241	159	82	12463	12599	6.6	10.6
3092.7	61	6	55	241	159	82	12468	12604	6.6	10.6
3093.8	61	6	55	241	159	82	12472	12609	6.6	10.6
3094.8	61	6	55	241	159	82	12477	12614	6.6	10.6
3095.8	61	6	55	241	159	82	12481	12618	6.6	10.6
3096.8	61	6	55	241	159	82	12485	12623	6.6	10.6
3097.9	61	6	55	241	159	82	12490	12627	6.6	10.6
3098.9	61	6	55	241	159	82	12494	12631	6.6	10.6
3099.9	61	6	55	241	159	82	12498	12635	6.6	10.6
3101.0	61	6	55	241	159	82	12503	12640	6.6	10.6
3102.0	61	6	55	241	159	82	12508	12646	6.6	10.6
3103.0	61	6	55	241	159	82	12513	12651	6.6	10.6
3104.0	61	6	55	241	159	82	12518	12656	6.6	10.6
3105.0	61	6	55	241	159	82	12524	12662	6.6	10.6
3106.1	61	6	55	241	159	82	12529	12667	6.6	10.6
3107.1	61	6	55	241	159	82	12533	12671	6.6	10.6
3108.1	61	6	55	241	159	82	12538	12676	6.6	10.6
3109.1	61	6	55	241	159	82	12543	12680	6.6	10.6
3110.2	61	6	55	241	159	82	12547	12685	6.6	10.6
3111.2	61	6	55	241	159	82	12552	12689	6.6	10.6
3112.2	61	6	55	241	159	82	12556	12694	6.6	10.6
3113.2	62	6	56	241	160	81	12561	12699	6.6	10.6
3114.2	62	6	56	241	160	81	12566	12703	6.6	10.6
3115.3	62	6	56	241	160	81	12571	12708	6.6	10.6
3116.3	62	6	56	242	161	81	12575	12713	6.6	10.6
3117.3	62	6	56	242	161	81	12580	12718	6.6	10.6
3118.3	62	6	56	242	161	81	12585	12723	6.6	10.6
3119.4	62	6	56	242	161	81	12590	12729	6.6	10.6
3120.4	62	6	56	242	161	81	12596	12734	10.3	10.6
3121.4	62	6	56	242	161	81	12602	12740	10.3	10.6
3122.4	62	6	56	242	161	81	12607	12746	6.6	10.6
3123.5	62	6	56	242	161	81	12613	12752	10.3	10.6
3124.5	62	6	56	242	161	81	12618	12757	6.6	10.6
3125.5	62	6	56	242	161	81	12623	12763	6.6	10.6
3126.5	62	6	56	242	161	81	12629	12768	10.3	10.6
3127.6	62	6	56	242	161	81	12634	12774	6.6	10.6
3128.6	62	6	56	242	161	81	12639	12779	6.6	10.6
3129.6	62	6	56	242	161	81	12645	12785	10.3	10.6
3130.6	62	6	56	242	161	81	12650	12790	6.6	10.6
3131.7	62	6	56	242	161	81	12656	12796	10.3	10.6
3132.7	62	6	56	243	161	82	12661	12801	6.6	10.6

TIME SEC.	L+ CNTS	R- CNTS	TOTAL R CNTS	B+ CNTS	B- CNTS	TOTAL B CNTS	ORF CNTS	OLR CNTS	SPEED-RF KM/SEC	SPEED-LF KM/SEC
3133.7	62	6	56	243	162	81	12666	12805	1.6	6.8
3134.7	62	6	56	243	162	81	12672	12810	10.3	8.6
3135.7	62	6	56	243	162	81	12677	12816	8.6	10.3
3136.8	62	6	56	243	162	81	12683	12821	10.3	8.6
3137.8	62	6	56	243	162	81	12688	12827	8.6	10.3
3138.8	62	6	56	243	162	81	12693	12833	8.6	10.3
3139.8	62	6	56	243	162	81	12699	12839	10.3	10.3
3140.9	62	6	56	243	162	81	12704	12845	8.6	10.3
3141.9	62	6	56	243	162	81	12710	12851	10.3	10.3
3142.9	62	6	56	243	162	81	12716	12857	10.3	10.3
3143.9	62	6	56	243	162	81	12723	12864	12.0	12.0
3145.0	62	6	56	243	162	81	12728	12869	8.6	8.6
3146.0	62	6	56	243	162	81	12732	12875	6.8	10.3
3147.0	62	6	56	243	162	81	12738	12880	10.3	8.6
3148.0	62	6	56	243	162	81	12746	12885	8.6	8.6
3149.1	62	6	56	243	162	81	12748	12890	8.6	8.6
3150.1	62	6	56	243	162	81	12753	12896	8.6	10.3
3151.1	62	6	56	243	162	81	12759	12902	10.3	10.3
3152.1	62	6	56	243	162	81	12765	12908	10.3	10.3
3153.2	62	6	56	244	162	82	12770	12914	8.6	10.3
3154.2	63	6	57	244	163	81	12776	12920	10.3	10.3
3155.2	63	6	57	245	163	82	12782	12925	10.3	8.6
3156.2	63	6	57	245	163	82	12788	12931	10.3	10.3
3157.2	63	6	57	245	163	82	12793	12936	8.6	8.6
3158.3	63	6	57	245	163	82	12798	12941	8.6	8.6
3159.3	63	6	57	245	163	82	12803	12945	8.6	8.6
3160.3	63	6	57	245	163	82	12808	12950	8.6	8.6
3161.3	63	6	57	245	163	82	12813	12954	8.6	8.6
3162.4	63	6	57	245	163	82	12818	12959	8.6	8.6
3163.4	63	6	57	245	163	82	12823	12964	8.6	8.6
3164.4	63	6	57	245	163	82	12828	12969	8.6	8.6
3165.4	63	6	57	245	163	82	12832	12973	6.8	8.6
3166.5	63	6	57	245	163	82	12836	12978	6.8	8.6
3167.5	63	6	57	245	163	82	12840	12981	6.8	5.1
3168.5	63	6	57	245	164	81	12844	12985	6.8	6.8
3169.5	63	6	57	245	164	81	12848	12989	6.8	6.8
3170.6	63	6	57	246	165	81	12851	12993	5.1	8.6
3171.6	63	6	57	246	165	81	12856	12997	8.6	6.8
3172.6	63	6	57	246	165	81	12860	13002	6.8	8.6
3173.6	63	6	57	246	165	81	12864	13007	6.8	8.6
3174.6	63	6	57	246	165	81	12869	13012	8.6	8.6
3175.7	63	6	57	246	165	81	12874	13017	8.6	8.6
3176.7	63	6	57	246	165	81	12878	13022	6.8	8.6
3177.7	63	6	57	246	165	81	12882	13027	6.8	8.6
3178.7	63	6	57	246	165	81	12887	13031	8.6	6.8
3179.8	63	6	57	246	165	81	12891	13036	6.8	8.6
3180.8	63	6	57	246	165	81	12895	13040	6.8	6.8
3181.8	63	6	57	246	165	81	12898	13043	5.1	5.1
3182.8	63	6	57	246	165	81	12901	13047	5.1	6.8
3183.9	63	6	57	246	165	81	12904	13050	5.1	5.1
3184.9	63	6	57	246	165	81	12906	13053	3.4	5.1
3185.9	63	6	57	246	165	81	12908	13055	3.4	3.4
3186.9	63	6	57	246	165	81	12910	13056	3.4	1.7
3188.0	63	6	57	246	165	81	12911	13058	1.7	3.4
3189.0	63	6	57	246	165	81	12913	13059	3.4	1.7
3190.0	63	6	57	246	165	81	12914	13060	1.7	1.7
3191.0	63	6	57	246	165	81	12915	13061	1.7	1.7
3192.1	63	6	57	246	165	81	12916	13062	1.7	1.7
3193.1	63	6	57	246	165	81	12918	13063	3.4	1.7
3194.1	63	6	57	246	165	81	12919	13064	1.7	1.7

TIME SEC.	R+ CNTS	R- CNTS	TOTAL R CNTS	F+ CNTS	B- CNTS	TOTAL B CNTS	ORF CNTS	OLR CNTS	SPEED-RF KM/HR.	SPEED-B KM/HR.
3195.1	63	6	57	246	165	81	12921	13065	3.4	1.7
3196.1	63	6	57	246	165	81	12922	13066	1.7	1.7
3197.2	63	6	57	246	165	81	12924	13068	3.4	3.4
3198.2	63	6	57	246	165	81	12927	13069	5.1	1.7
3199.2	63	6	57	246	165	81	12929	13071	3.4	3.4
3200.2	63	6	57	246	165	81	12931	13072	3.4	1.7
3201.3	63	6	57	246	165	81	12934	13074	5.1	3.4
3202.3	63	6	57	246	165	81	12937	13077	5.1	5.1
3203.3	63	6	57	246	165	81	12940	13080	5.1	5.1
3204.3	63	6	57	246	165	81	12943	13083	5.1	5.1
3205.4	63	6	57	246	165	81	12947	13087	6.8	6.8
3206.4	63	6	57	247	165	82	12952	13091	8.6	6.8
3207.4	63	6	57	247	165	82	12957	13095	8.6	6.8
3208.4	63	6	57	247	165	82	12962	13101	8.6	10.3
3209.5	63	6	57	247	165	82	12967	13105	8.6	8.6
3210.5	63	6	57	247	165	82	12973	13111	10.3	10.3
3211.5	63	6	57	247	165	82	12979	13117	10.3	10.3
3212.5	63	6	57	247	165	82	12985	13124	10.3	12.0
3213.6	63	6	57	247	165	82	12992	13131	12.0	12.0
3214.6	63	6	57	247	165	82	12998	13138	10.3	12.0
3215.6	63	6	57	247	165	82	13005	13144	12.0	10.3
3216.6	63	6	57	247	165	82	13014	13152	15.5	13.7
3217.6	63	6	57	247	165	82	13019	13156	8.6	10.3
3218.7	63	6	57	247	165	82	13025	13164	10.3	10.3
3219.7	63	6	57	247	165	82	13029	13169	6.8	8.6
3220.7	63	6	57	247	166	81	13034	13174	8.6	8.6
3221.7	63	6	57	247	166	81	13039	13179	8.6	8.6
3222.8	63	6	57	247	166	81	13044	13184	8.6	8.6
3223.8	63	6	57	247	166	81	13049	13189	8.6	8.6
3224.8	63	6	57	247	166	81	13053	13194	6.8	8.6
3225.8	63	6	57	247	166	81	13057	13199	6.8	8.6
3226.9	63	6	57	247	166	81	13061	13203	6.8	8.6
3227.9	63	6	57	247	166	81	13065	13207	6.8	8.6
3228.9	63	6	57	247	166	81	13068	13210	5.1	6.8
3229.9	63	6	57	247	166	81	13072	13214	6.8	6.8
3231.0	63	6	57	247	166	81	13076	13217	6.8	5.1
3232.0	63	6	57	247	166	81	13079	13221	5.1	6.8
3233.0	63	6	57	247	166	81	13083	13226	6.8	6.8
3234.0	63	6	57	247	166	81	13086	13230	5.1	6.8
3235.1	63	6	57	247	166	81	13089	13235	5.1	6.8
3236.1	63	6	57	247	166	81	13092	13239	5.1	5.1
3237.1	63	6	57	247	166	81	13094	13242	3.4	5.1
3238.1	63	6	57	247	166	81	13097	13245	5.1	5.1
3239.1	63	6	57	247	166	81	13099	13247	3.4	3.4
3240.2	63	6	57	247	166	81	13101	13249	3.4	3.4
3241.2	63	6	57	247	166	81	13103	13251	3.4	3.4
3242.2	63	6	57	247	166	81	13106	13255	5.1	6.8
3243.2	63	6	57	247	166	81	13109	13258	5.1	5.1
3244.3	63	6	57	247	166	81	13113	13262	6.8	6.8
3245.3	63	6	57	247	166	81	13117	13266	6.8	6.8
3246.3	63	6	57	247	166	81	13122	13271	8.6	6.8
3247.3	63	6	57	247	166	81	13127	13276	8.6	8.6
3248.4	63	6	57	247	166	81	13132	13281	8.6	8.6
3249.4	63	6	57	247	166	81	13137	13286	8.6	8.6
3250.4	63	6	57	247	166	81	13142	13292	8.6	10.3
3251.4	63	6	57	247	166	81	13147	13297	8.6	8.6
3252.5	63	6	57	247	166	81	13152	13302	8.6	8.6
3253.5	63	6	57	247	166	81	13156	13307	6.8	8.6
3254.5	63	6	57	247	166	81	13159	13311	5.1	6.8
3255.5	63	6	57	247	166	81	13163	13315	6.8	6.8

TIME SEC.	R+ CNTS	R- CNTS	TOTAL R CNTS	L+ CNTS	L- CNTS	TOTAL B CNTS	ORF CNTS	OLR CNTS	SPEED-RF KM/HR.	SPEED-LF KM/HR.
3256.5	63	6	57	247	166	81	13167	13319	6.8	6.8
3257.6	63	6	57	247	166	81	13171	13323	6.8	6.8
3258.6	63	6	57	247	166	81	13176	13327	8.6	6.8
3259.6	63	6	57	247	166	81	13180	13331	6.8	6.8
3260.6	63	6	57	247	166	81	13185	13336	8.6	8.6
3261.7	63	6	57	247	166	81	13189	13340	6.8	6.8
3262.7	63	6	57	247	166	81	13193	13345	6.8	8.6
3263.7	63	6	57	247	166	81	13198	13349	8.6	6.8
3264.7	63	6	57	247	166	81	13202	13353	6.8	6.8
3265.8	63	6	57	247	166	81	13206	13357	6.8	6.8
3266.8	64	6	58	247	166	81	13211	13362	8.6	8.6
3267.8	64	6	58	247	166	81	13215	13367	6.8	8.6
3268.8	64	6	58	247	166	81	13219	13371	6.8	6.8
3269.9	64	6	58	247	166	81	13224	13375	8.6	6.8
3270.9	64	6	58	247	166	81	13228	13379	6.8	6.8
3271.9	64	6	58	247	166	81	13232	13383	6.8	6.8
3272.9	64	6	58	247	166	81	13236	13387	6.8	6.8
3274.0	64	6	58	247	166	81	13240	13391	6.8	6.8
3275.0	64	6	58	247	166	81	13244	13395	6.8	6.8
3276.0	64	6	58	247	166	81	13249	13400	8.6	8.6
3277.0	64	6	58	247	166	81	13253	13403	6.8	5.1
3278.0	64	6	58	247	166	81	13256	13407	5.1	6.8
3279.1	64	6	58	247	166	81	13260	13411	6.8	6.8
3280.1	64	6	58	247	166	81	13264	13415	6.8	6.8
3281.1	64	6	58	247	166	81	13268	13419	6.8	6.8
3282.1	64	6	58	247	166	81	13272	13424	6.8	8.6
3283.2	64	6	58	247	166	81	13276	13428	6.8	6.8
3284.2	64	6	58	247	166	81	13280	13432	8.6	8.6
3285.2	64	6	58	247	166	81	13285	13437	8.6	8.6
3286.2	64	6	58	247	166	81	13290	13442	8.6	8.6
3287.3	64	6	58	247	166	81	13295	13447	8.6	8.6
3288.3	64	6	58	247	166	81	13300	13452	8.6	8.6
3289.3	64	6	58	247	166	81	13305	13456	8.6	8.6
3290.3	64	6	58	247	166	81	13310	13461	8.6	8.6
3291.4	64	6	58	247	166	81	13314	13465	6.8	6.8
3292.4	64	6	58	247	166	81	13319	13470	8.6	8.6
3293.4	64	6	58	247	166	81	13323	13475	6.8	8.6
3294.4	64	6	58	247	166	81	13328	13480	8.6	8.6
3295.5	64	6	58	247	166	81	13332	13485	6.8	8.6
3296.5	64	6	58	247	166	81	13337	13490	8.6	8.6
3297.5	64	6	58	247	166	81	13343	13494	10.3	6.8
3298.5	64	6	58	247	166	81	13348	13499	8.6	8.6
3299.5	64	6	58	247	166	81	13352	13504	6.8	8.6
3300.6	64	6	58	247	166	81	13357	13509	8.6	8.6
3301.6	64	6	58	247	166	81	13362	13514	8.6	8.6
3302.6	64	6	58	247	166	81	13367	13519	8.6	8.6
3303.6	64	6	58	247	166	81	13372	13524	8.6	8.6
3304.7	64	6	58	247	166	81	13377	13529	8.6	8.6
3305.7	64	6	58	247	167	80	13383	13535	10.3	10.3
3306.7	64	6	58	247	167	80	13388	13540	8.6	8.6
3307.7	64	6	58	247	167	80	13392	13545	6.8	8.6
3308.8	64	6	58	247	167	80	13397	13551	8.6	10.3
3309.8	64	6	58	247	167	80	13402	13556	8.6	8.6
3310.8	64	6	58	247	167	80	13407	13561	8.6	8.6
3311.8	64	6	58	247	167	80	13413	13567	10.3	10.3
3312.9	64	6	58	247	167	80	13417	13573	6.8	10.3
3313.9	64	6	58	247	167	80	13422	13577	8.6	6.8
3314.9	64	6	58	247	167	80	13427	13582	8.6	8.6
3315.9	64	6	58	247	167	80	13431	13586	6.8	6.8
3317.0	64	6	58	247	167	80	13436	13591	8.6	8.6

TIME SEC.	R+ CNTS	R- CNTS	TOTAL R CNTS	B+ CNTS	B- CNTS	TOTAL B CNTS	ORF CNTS	OLR CNTS	SPEED-RF KM/HR.	SPEED-L KM/HR.
3318.0	64	6	58	247	167	80	13441	13596	6.6	8.6
3319.0	64	6	58	247	167	80	13444	13601	5.1	8.6
3320.0	64	6	58	247	167	80	13446	13605	3.4	6.8
3321.0	64	6	58	247	167	80	13447	13605	1.7	.0
3322.1	64	6	58	247	167	80	13449	13605	3.4	1.7
3323.1	64	6	58	247	167	80	13450	13608	1.7	3.4
3324.1	64	6	58	247	167	80	13453	13610	5.1	3.4
3325.1	64	6	58	247	167	80	13455	13612	3.4	3.4
3326.2	64	6	58	247	167	80	13458	13615	5.1	5.1
3327.2	64	6	58	247	167	80	13461	13617	5.1	3.4
3328.2	64	6	58	247	167	80	13465	13620	6.8	5.1
3329.2	64	6	58	247	167	80	13468	13623	5.1	5.1
3330.3	64	6	58	247	167	80	13472	13627	6.8	6.8
3331.3	64	6	58	247	167	80	13476	13631	6.8	6.8
3332.3	64	6	58	247	167	80	13480	13636	6.8	6.8
3333.3	64	6	58	247	167	80	13484	13640	6.8	6.8
3334.4	64	6	58	247	167	80	13488	13645	6.8	5.1
3335.4	64	6	58	247	167	80	13492	13647	6.8	3.4
3336.4	64	6	58	247	167	80	13496	13650	6.8	5.1
3337.4	64	6	58	247	167	80	13499	13654	5.1	6.8
3338.4	64	6	58	247	167	80	13503	13657	6.8	5.1
3339.5	64	6	58	247	167	80	13506	13661	5.1	6.8
3340.5	64	6	58	247	167	80	13510	13664	6.8	5.1
3341.5	64	6	58	247	167	80	13514	13668	6.8	6.8
3342.5	64	6	58	247	167	80	13519	13672	8.6	6.8
3343.6	64	6	58	247	167	80	13523	13675	6.8	5.1
3344.6	64	6	58	247	167	80	13526	13679	5.1	5.1
3345.6	64	6	58	247	167	80	13529	13683	5.1	6.8
3346.6	64	6	58	247	167	80	13533	13686	6.8	6.8
3347.7	64	6	58	247	167	80	13538	13692	8.6	6.8
3348.7	64	6	58	247	167	80	13542	13697	6.8	8.6
3349.7	64	6	58	247	167	80	13547	13702	8.6	8.6
3350.7	64	6	58	247	167	80	13552	13707	8.6	8.6
3351.8	64	6	58	247	167	80	13557	13713	8.6	10.3
3352.8	64	6	58	247	167	80	13563	13718	10.3	8.6
3353.8	64	6	58	247	167	80	13569	13724	10.3	10.3
3354.8	64	6	58	247	167	80	13575	13730	10.3	10.3
3355.9	64	6	58	247	167	80	13580	13736	8.6	10.3
3356.9	64	6	58	247	167	80	13586	13742	10.3	10.3
3357.9	64	6	58	247	167	80	13591	13748	8.6	10.3
3358.9	65	6	59	247	167	80	13597	13753	10.3	8.6
3359.9	65	6	59	247	167	80	13601	13758	6.8	8.6
3361.0	65	6	59	247	167	80	13606	13762	8.6	6.8
3362.0	65	6	59	244	167	80	13611	13767	8.6	8.6
3363.0	65	6	59	247	167	80	13615	13772	6.8	8.6
3364.0	65	6	59	247	167	80	13620	13777	8.6	8.6
3365.1	65	6	59	247	167	80	13624	13782	6.8	8.6
3366.1	65	6	59	247	167	80	13629	13788	8.6	10.3
3367.1	65	6	59	247	167	80	13634	13793	8.6	8.6
3368.1	65	6	59	247	167	80	13640	13798	10.3	8.6
3369.2	65	6	59	247	167	80	13645	13802	8.6	6.8
3370.2	65	6	59	247	168	79	13650	13807	8.6	8.6
3371.2	65	6	59	247	168	79	13654	13812	6.8	8.6
3372.2	65	6	59	247	168	79	13659	13817	8.6	8.6
3373.3	65	6	59	247	168	79	13663	13822	6.8	8.6
3374.3	65	6	59	247	168	79	13667	13827	6.8	8.6
3375.3	65	6	59	247	168	79	13671	13831	6.8	6.8
3376.3	65	6	59	247	168	79	13676	13835	8.6	6.8
3377.4	65	6	59	247	168	79	13680	13840	6.8	8.6
3378.4	65	6	59	247	168	79	13685	13845	8.6	8.6

TIME SEC.	R+ CNTS	R- CNTS	TOTAL R CNTS	B+ CNTS	B- CNTS	TOTAL B CNTS	ORF CNTS	OLR CNTS	SPEED-RF KM/HR.	SPEED-LF KM/HR.
3379.4	65	6	59	247	168	79	13690	13850	8.6	8.6
3380.4	65	6	59	247	168	79	13695	13855	8.6	8.6
3381.4	65	6	59	247	168	79	13700	13860	8.6	8.6
3382.5	65	6	59	247	168	79	13705	13865	8.6	8.6
3383.5	65	6	59	247	168	79	13710	13870	8.6	8.6
3384.5	65	6	59	247	168	79	13715	13877	8.6	12.0
3385.5	65	6	59	247	168	79	13720	13882	8.6	8.6
3386.6	65	6	59	247	168	79	13725	13886	8.6	6.8
3387.6	65	6	59	247	168	79	13730	13891	8.6	8.6
3388.6	65	6	59	247	168	79	13735	13897	8.6	10.3
3389.6	65	6	59	247	168	79	13740	13902	8.6	8.6
3390.7	65	6	59	247	168	79	13744	13907	6.8	8.6
3391.7	65	6	59	247	168	79	13748	13911	6.8	6.8
3392.7	65	6	59	247	168	79	13753	13917	8.6	10.3
3393.7	65	6	59	247	168	79	13758	13921	8.6	6.8
3394.8	65	6	59	247	168	79	13762	13926	6.8	8.6
3395.8	65	6	59	247	168	79	13767	13931	8.6	8.6
3396.8	65	6	59	247	168	79	13771	13936	6.8	8.6
3397.8	65	6	59	247	168	79	13776	13941	8.6	8.6
3398.9	65	6	59	247	168	79	13780	13946	6.8	8.6
3399.9	65	6	59	247	168	79	13786	13951	10.3	8.6
3400.9	65	6	59	247	168	79	13790	13956	6.8	8.6
3401.9	65	6	59	247	168	79	13795	13961	8.6	8.6
3402.9	65	6	59	247	168	79	13800	13966	8.6	8.6
3404.0	65	6	59	247	168	79	13805	13971	8.6	8.6
3405.0	65	6	59	247	168	79	13810	13977	8.6	10.3
3406.0	65	6	59	247	168	79	13815	13982	8.6	8.6
3407.0	65	6	59	247	168	79	13820	13987	8.6	8.6
3408.1	66	6	60	247	168	79	13826	13992	10.3	8.6
3409.1	66	6	60	247	168	79	13831	13997	8.6	8.6
3410.1	66	6	60	247	168	79	13836	14003	8.6	10.3
3411.1	66	6	60	247	168	79	13841	14008	8.6	8.6
3412.2	66	6	60	247	168	79	13846	14013	8.6	8.6
3413.2	66	6	60	247	168	79	13850	14018	6.8	8.6
3414.2	66	6	60	247	168	79	13855	14022	8.6	6.8
3415.2	66	6	60	247	168	79	13859	14027	6.8	8.6
3416.3	66	6	60	247	168	79	13863	14031	6.8	6.8
3417.3	66	6	60	247	168	79	13868	14036	8.6	8.6
3418.3	66	6	60	247	168	79	13873	14041	8.6	8.6
3419.3	66	6	60	247	168	79	13878	14046	8.6	8.6
3420.3	66	6	60	247	168	79	13884	14052	10.3	10.3
3421.4	66	6	60	247	168	79	13889	14057	8.6	8.6
3422.4	66	6	60	247	168	79	13894	14062	8.6	8.6
3423.4	66	6	60	247	168	79	13899	14067	8.6	8.6
3424.4	66	6	60	247	168	79	13904	14073	8.6	10.3
3425.5	66	6	60	247	168	79	13910	14078	10.3	8.6
3426.5	66	6	60	247	168	79	13915	14083	8.6	8.6
3427.5	66	6	60	247	168	79	13920	14088	8.6	8.6
3428.5	66	6	60	247	168	79	13924	14094	6.8	10.3
3429.6	66	6	60	247	168	79	13929	14099	8.6	8.6
3430.6	66	6	60	247	168	79	13933	14103	6.8	6.8
3431.6	66	6	60	247	168	79	13937	14107	6.8	6.8
3432.6	66	6	60	247	168	79	13941	14110	6.8	5.1
3433.7	66	6	60	247	168	79	13946	14115	8.6	8.6
3434.7	66	6	60	247	168	79	13949	14118	5.1	5.1
3435.7	66	6	60	247	168	79	13953	14123	6.8	8.6
3436.7	66	6	60	247	168	79	13957	14127	6.8	6.8
3437.8	66	6	60	247	168	79	13961	14131	6.8	6.8
3438.8	66	6	60	247	168	79	13964	14134	5.1	5.1
3439.8	66	6	60	247	168	79	13968	14138	6.8	6.8

TIME SEC.	R+ CNTS	R- CNTS	TOTAL R CNTS	B+ CNTS	B- CNTS	TOTAL B CNTS	ORT CNTS	OLR CNTS	SPEED-RF KM/HR.	SPEED-LF KM/HR.
3440.8	66	6	60	247	168	79	13972	14142	6.8	6.8
3441.8	66	6	60	247	168	79	13976	14146	6.8	6.8
3442.9	66	6	60	247	168	79	13980	14150	6.8	6.8
3443.9	66	6	60	247	168	79	13985	14155	8.6	8.6
3444.9	66	6	60	247	168	79	13990	14160	8.6	8.6
3445.9	66	6	60	247	168	79	13994	14163	6.8	5.1
3447.0	66	6	60	247	168	79	13997	14167	5.1	6.8
3448.0	66	6	60	247	168	79	14001	14170	6.8	5.1
3449.0	66	6	60	247	168	79	14005	14174	6.8	6.8
3450.0	66	6	60	247	168	79	14009	14178	6.8	6.8
3451.1	66	6	60	247	168	79	14014	14182	8.6	6.8
3452.1	66	6	60	247	168	79	14017	14185	5.1	5.1
3453.1	66	6	60	247	168	79	14021	14189	6.8	6.8
3454.1	66	6	60	247	168	79	14024	14192	5.1	5.1
3455.2	66	6	60	247	168	79	14028	14196	6.8	6.8
3456.2	66	6	60	247	168	79	14032	14199	6.8	5.1
3457.2	66	6	60	247	168	79	14036	14203	6.8	6.8
3458.2	67	6	61	247	168	79	14040	14207	6.8	6.8
3459.3	67	6	61	247	168	79	14044	14211	6.8	6.8
3460.3	67	6	61	247	168	79	14048	14215	6.8	6.8
3461.3	67	6	61	247	168	79	14053	14220	8.6	8.6
3462.3	67	6	61	247	168	79	14057	14224	6.8	6.8
3463.3	67	6	61	247	168	79	14061	14229	6.8	8.6
3464.4	67	6	61	247	168	79	14065	14233	6.8	6.8
3465.4	67	6	61	247	168	79	14069	14238	6.8	8.6
3466.4	67	6	61	247	168	79	14074	14242	8.6	6.8
3467.4	67	6	61	247	168	79	14079	14247	8.6	8.6
3468.5	67	6	61	247	168	79	14083	14252	6.8	8.6
3469.5	67	6	61	247	168	79	14088	14257	8.6	8.6
3470.5	67	6	61	247	168	79	14092	14262	6.8	8.6
3471.5	67	6	61	247	168	79	14097	14268	8.6	10.3
3472.6	67	6	61	247	168	79	14101	14273	6.8	8.6
3473.6	67	6	61	247	168	79	14106	14279	8.6	10.3
3474.6	67	6	61	247	168	79	14111	14284	8.6	8.6
3475.6	67	6	61	247	168	79	14116	14290	8.6	10.3
3476.7	67	6	61	247	168	79	14121	14295	8.6	8.6
3477.7	67	6	61	247	168	79	14126	14301	8.6	10.3
3478.7	67	6	61	247	168	79	14132	14307	10.3	10.3
3479.7	67	6	61	247	168	79	14137	14312	8.6	8.6
3480.8	67	6	61	247	168	79	14143	14318	10.3	10.3
3481.8	67	6	61	247	168	79	14148	14323	8.6	8.6
3482.8	67	6	61	247	168	79	14153	14329	8.6	10.3
3483.8	67	6	61	247	168	79	14158	14334	8.6	8.6
3484.8	67	6	61	247	168	79	14162	14337	6.8	5.1
3485.9	67	6	61	247	168	79	14166	14342	6.8	8.6
3486.9	67	6	61	247	168	79	14171	14346	8.6	6.8
3487.9	67	6	61	247	168	79	14175	14350	6.8	6.8
3488.9	67	6	61	247	168	79	14179	14355	6.8	8.6
3490.0	67	6	61	247	168	79	14183	14360	6.8	8.6
3491.0	67	6	61	247	168	79	14187	14364	6.8	6.8
3492.0	67	6	61	247	168	79	14192	14369	8.6	8.6
3493.0	67	6	61	247	168	79	14196	14373	6.8	6.8
3494.1	67	6	61	247	168	79	14200	14377	6.8	6.8
3495.1	67	6	61	247	168	79	14204	14382	6.8	8.6
3496.1	67	6	61	247	168	79	14208	14386	6.8	6.8
3497.1	67	6	61	247	168	79	14212	14390	6.8	6.8
3498.2	67	6	61	247	168	79	14216	14394	6.8	6.8
3499.2	67	6	61	247	168	79	14220	14398	6.8	6.8
3500.2	67	6	61	247	168	79	14224	14401	6.8	5.1
3501.2	67	6	61	247	168	79	14228	14406	6.8	8.6

TIME SEC.	R+ CNTS	R- CNTS	TOTAL R CNTS	B+ CNTS	B- CNTS	TOTAL B CNTS	ORF CNTS	OLR CNTS	SPEED-RF KM/HR.	SPEED-LR KM/HR.
3502.2	67	6	61	247	168	79	14232	14410	6.8	6.8
3503.3	67	6	61	247	168	79	14236	14414	6.8	6.8
3504.3	67	6	61	247	168	79	14240	14418	6.8	6.8
3505.3	67	6	61	247	168	79	14244	14422	6.8	6.8
3506.3	67	6	61	247	168	79	14249	14426	8.6	6.8
3507.4	67	6	61	247	168	79	14253	14431	6.8	8.6
3508.4	67	6	61	247	168	79	14257	14435	6.8	6.8
3509.4	67	6	61	247	168	79	14261	14439	6.8	6.8
3510.4	67	6	61	247	168	79	14265	14444	6.8	8.6
3511.5	67	6	61	247	168	79	14270	14448	8.6	6.8
3512.5	67	6	61	247	168	79	14274	14453	6.8	8.6
3513.5	67	6	61	247	169	78	14278	14457	6.8	6.8
3514.5	67	6	61	247	169	78	14282	14462	6.8	8.6
3515.6	67	6	61	247	169	78	14286	14465	6.8	5.1
3516.6	67	6	61	247	169	78	14290	14469	6.8	6.8
3517.6	67	6	61	247	169	78	14293	14474	5.1	8.6
3518.6	67	6	61	247	169	78	14297	14478	6.8	6.8
3519.7	67	6	61	247	169	78	14301	14482	6.8	6.8
3520.7	67	6	61	247	169	78	14305	14486	6.8	6.8
3521.7	67	6	61	247	169	78	14309	14490	6.8	6.8
3522.7	67	6	61	247	169	78	14312	14494	5.1	6.8
3523.7	67	6	61	247	169	78	14315	14496	5.1	3.4
3524.8	67	6	61	247	169	78	14319	14499	6.8	5.1
3525.8	67	6	61	247	169	78	14323	14503	6.8	6.8
3526.8	68	6	62	247	169	78	14327	14507	6.8	6.8
3527.8	68	6	62	247	169	78	14331	14510	6.8	5.1
3528.9	68	6	62	247	169	78	14334	14514	5.1	6.8
3529.9	68	6	62	247	169	78	14338	14518	6.8	6.8
3530.9	68	6	62	247	169	78	14342	14521	6.8	5.1
3531.9	68	6	62	247	169	78	14346	14526	6.8	8.6
3533.0	68	6	62	247	169	78	14350	14530	6.8	6.8
3534.0	68	6	62	247	169	78	14354	14534	6.8	6.8
3535.0	68	6	62	247	169	78	14358	14538	6.8	6.8
3536.0	68	6	62	247	169	78	14362	14542	6.8	6.8
3537.1	68	6	62	247	169	78	14366	14546	6.8	6.8
3538.1	68	6	62	247	169	78	14370	14551	6.8	8.6
3539.1	68	6	62	247	169	78	14374	14555	6.8	6.8
3540.1	68	6	62	247	169	78	14378	14559	6.8	6.8
3541.2	68	6	62	247	169	78	14382	14563	6.8	6.8
3542.2	68	6	62	247	169	78	14385	14567	5.1	6.8
3543.2	68	6	62	247	169	78	14389	14571	6.8	6.8
3544.2	68	6	62	247	169	78	14393	14576	6.8	8.6
3545.3	68	6	62	247	169	78	14397	14580	6.8	6.8
3546.3	68	6	62	247	169	78	14401	14585	6.8	8.6
3547.3	68	6	62	247	169	78	14406	14589	8.6	6.8
3548.3	68	6	62	247	169	78	14410	14594	6.8	8.6
3549.3	68	6	62	247	169	78	14414	14598	6.8	6.8
3550.4	68	6	62	247	169	78	14418	14602	6.8	6.8
3551.4	68	6	62	247	169	78	14422	14607	6.8	8.6
3552.4	68	6	62	247	169	78	14427	14611	8.6	6.8
3553.4	68	6	62	247	169	78	14431	14616	6.8	8.6
3554.5	68	6	62	247	169	78	14435	14620	6.8	6.8
3555.5	68	6	62	247	169	78	14439	14624	6.8	6.8
3556.5	68	6	62	247	169	78	14443	14629	6.8	8.6
3557.5	68	6	62	247	169	78	14447	14633	6.8	6.8
3558.6	68	6	62	247	169	78	14452	14638	8.6	8.6
3559.6	68	6	62	247	169	78	14457	14643	8.6	8.6
3560.6	68	6	62	247	169	78	14462	14649	8.6	10.3
3561.6	68	6	62	247	169	78	14467	14654	8.6	8.6
3562.7	68	6	62	247	169	78	14471	14659	6.8	8.6

TIME SEC.	R+ CNTS	R- CNTS	TOTAL R CNTS	B+ CNTS	B- CNTS	TOTAL B CNTS	ORF CNTS	OLR CNTS	SPEED-RF KM/I.R.	SPEED-LR KM/I.R.
3563.7	68	6	62	247	169	78	14476	14664	8.6	8.6
3564.7	68	6	62	247	169	78	14480	14668	6.8	6.8
3565.7	68	6	62	247	169	78	14485	14673	8.6	8.6
3566.7	68	6	62	247	169	78	14489	14677	6.8	6.8
3567.8	68	6	62	247	169	78	14493	14682	6.8	8.6
3568.8	68	6	62	247	169	78	14498	14687	8.6	8.6
3569.8	68	6	62	247	169	78	14503	14691	8.6	6.8
3570.8	68	6	62	247	169	78	14507	14695	6.8	6.8
3571.9	68	6	62	247	169	78	14511	14699	6.8	6.8
3572.9	68	6	62	247	169	78	14516	14704	8.6	8.6
3573.9	68	6	62	247	169	78	14521	14709	8.6	8.6
3574.9	68	6	62	247	169	78	14526	14714	8.6	8.6
3576.0	68	6	62	247	169	78	14531	14719	8.6	8.6
3577.0	69	6	63	247	169	78	14535	14724	6.8	8.6
3578.0	69	6	63	247	169	78	14540	14729	8.6	8.6
3579.0	69	6	63	247	169	78	14544	14734	6.8	8.6
3580.1	69	6	63	247	169	78	14549	14739	8.6	8.6
3581.1	69	6	63	247	169	78	14553	14744	8.8	8.6
3582.1	69	6	63	247	169	78	14557	14748	6.8	6.8
3583.1	69	6	63	247	169	78	14562	14753	8.6	8.6
3584.1	69	6	63	247	169	78	14566	14757	6.8	6.8
3585.2	69	6	63	247	169	78	14570	14761	6.8	6.8
3586.2	69	6	63	247	169	78	14574	14765	6.8	6.8
3587.2	69	6	63	247	169	78	14577	14769	5.1	6.8
3588.2	69	6	63	247	169	78	14581	14773	6.8	6.8
3589.3	69	6	63	247	169	78	14585	14777	6.8	6.8
3590.3	69	6	63	247	169	78	14589	14782	6.8	8.6
3591.3	69	6	63	247	169	78	14593	14785	6.8	5.1
3592.3	69	6	63	247	169	78	14597	14789	6.8	6.8
3593.4	69	6	63	247	169	78	14600	14792	5.1	5.1
3594.4	69	6	63	247	169	78	14604	14796	6.8	6.8
3595.4	69	6	63	247	169	78	14609	14800	8.6	6.8
3596.4	69	6	63	247	169	78	14613	14805	6.8	8.6
3597.5	69	6	63	247	169	78	14617	14808	6.8	5.1
3598.5	69	6	63	247	169	78	14621	14811	6.8	5.1
3599.5	69	6	63	247	169	78	14625	14815	6.8	6.8
3600.5	69	6	63	247	169	78	14630	14820	8.6	8.6
3601.6	69	6	63	247	169	78	14634	14825	6.8	8.6
3602.6	69	6	63	247	169	78	14639	14830	8.6	8.6
3603.6	69	6	63	247	169	78	14643	14834	6.8	6.8
3604.6	69	6	63	247	169	78	14648	14839	8.6	8.6
3605.6	69	6	63	247	169	78	14652	14843	6.8	6.8
3606.7	69	6	63	247	169	78	14657	14848	8.6	8.6
3607.7	69	6	63	247	169	78	14662	14853	8.6	8.6
3608.7	69	6	63	247	169	78	14666	14858	6.8	8.6
3609.7	69	6	63	247	169	78	14671	14864	8.6	10.3
3610.8	69	6	63	247	169	78	14675	14868	6.8	6.8
3611.8	69	6	63	247	169	78	14680	14872	8.6	6.8
3612.8	69	6	63	247	169	78	14684	14877	6.8	8.6
3613.8	69	6	63	247	169	78	14689	14882	8.6	8.6
3614.9	69	6	63	247	169	78	14693	14887	6.8	8.6
3615.9	69	6	63	247	169	78	14698	14891	8.6	6.8
3616.9	69	6	63	247	169	78	14703	14897	8.6	10.3
3617.9	69	6	63	247	169	78	14709	14902	10.3	8.6
3619.0	69	6	63	247	169	78	14713	14907	6.8	8.6
3620.0	69	6	63	247	169	78	14718	14912	8.6	8.6
3621.0	69	6	63	247	169	78	14723	14917	8.6	8.6
3622.0	69	6	63	247	169	78	14728	14922	8.6	8.6
3623.1	69	6	63	247	169	78	14732	14926	6.8	6.8
3624.1	69	6	63	247	169	78	14736	14931	6.8	8.6

TIME SEC.	R+ CNTS	R- CNTS	TOTAL R CNTS	L+ CNTS	L- CNTS	TOTAL L CNTS	ORF CNTS	OLR CNTS	SPEED-RF KM/HR.	SPEED-LR KM/HR.
3625.1	69	6	63	247	169	76	14741	14935	8.6	6.8
3626.1	69	6	63	247	169	78	14746	14940	8.6	8.6
3627.1	69	6	63	247	169	78	14751	14945	8.6	8.6
3628.2	70	6	64	247	169	78	14756	14950	8.6	8.6
3629.2	70	6	64	247	169	78	14762	14956	10.3	10.3
3630.2	70	6	64	247	169	78	14767	14962	8.6	10.3
3631.2	70	6	64	247	169	78	14772	14967	8.6	8.6
3632.3	70	6	64	247	169	78	14777	14972	8.6	8.6
3633.3	70	6	64	247	169	78	14782	14978	8.6	10.3
3634.3	70	6	64	247	169	78	14787	14983	8.6	8.6
3635.3	70	6	64	247	169	78	14793	14989	10.3	10.3
3636.4	70	6	64	247	169	78	14799	14995	10.3	10.3
3637.4	70	6	64	247	169	78	14805	15001	10.3	10.3
3638.4	70	6	64	247	169	78	14810	15007	8.6	10.3
3639.4	70	6	64	247	169	78	14816	15014	10.3	12.0
3640.5	70	6	64	244	169	78	14821	15019	8.6	8.6
3641.5	70	6	64	247	169	78	14826	15025	8.6	10.3
3642.5	70	6	64	247	169	78	14830	15031	8.6	10.3
3643.5	70	6	64	247	169	78	14835	15037	8.6	10.3
3644.6	70	6	64	247	169	78	14840	15042	8.6	8.6
3645.6	70	6	64	247	169	78	14845	15047	8.6	8.6
3646.6	70	6	64	247	169	78	14850	15052	8.6	8.6
3647.6	70	6	64	247	169	78	14856	15058	10.3	10.3
3648.6	70	6	64	247	169	78	14862	15065	10.3	12.0
3649.7	70	6	64	247	169	78	14868	15071	10.3	10.3
3650.7	70	6	64	247	169	78	14873	15077	8.6	10.3
3651.7	70	6	64	247	169	78	14879	15083	10.3	10.3
3652.7	70	6	64	247	169	78	14884	15088	8.6	8.6
3653.8	70	6	64	247	169	78	14889	15094	8.6	10.3
3654.8	70	6	64	247	169	78	14895	15099	10.3	8.6
3655.8	70	6	64	247	169	78	14900	15105	8.6	10.3
3656.8	70	6	64	247	169	78	14905	15110	8.6	8.6
3657.9	70	6	64	247	169	78	14909	15115	8.6	8.6
3658.9	70	6	64	247	169	78	14914	15121	8.6	10.3
3659.9	70	6	64	247	169	78	14919	15126	8.6	8.6
3660.9	70	6	64	247	169	78	14924	15131	8.6	8.6
3662.0	70	6	64	247	169	78	14929	15136	8.6	8.6
3663.0	70	6	64	247	169	78	14934	15141	8.6	8.6
3664.0	70	6	64	247	169	78	14938	15146	6.8	8.6
3665.0	70	6	64	247	169	78	14943	15151	8.6	8.6
3666.0	70	6	64	247	169	78	14948	15156	8.6	8.6
3667.1	70	6	64	247	169	78	14953	15161	8.6	8.6
3668.1	70	6	64	247	169	78	14958	15167	8.6	10.3
3669.1	70	6	64	247	169	78	14963	15172	8.6	8.6
3670.1	70	6	64	247	169	78	14967	15177	6.8	8.6
3671.2	70	6	64	247	169	78	14972	15181	8.6	6.8
3672.2	71	6	65	247	169	78	14977	15186	8.6	8.6
3673.2	71	6	65	247	169	78	14982	15191	8.6	8.6
3674.2	71	6	65	247	169	78	14987	15196	8.6	8.6
3675.3	71	6	65	247	169	78	14992	15201	8.6	8.6
3676.3	71	6	65	247	169	78	14997	15206	8.6	8.6
3677.3	71	6	65	247	169	78	15001	15211	6.8	8.6
3678.3	71	6	65	247	169	78	15006	15215	8.6	6.8
3679.4	71	6	65	247	169	78	15011	15220	8.6	8.6
3680.4	71	6	65	247	169	78	15015	15225	6.8	8.6
3681.4	71	6	65	247	169	78	15020	15230	8.6	8.6
3682.4	71	6	65	247	169	78	15025	15235	8.6	8.6
3683.5	71	6	65	247	169	78	15030	15240	8.6	8.6
3684.5	71	6	65	247	169	78	15035	15246	8.6	10.3
3685.5	71	6	65	247	169	78	15040	15251	8.6	8.6

TIME SLC•	R+ CNTS	R- CNTS	TOTAL R CNTS	B+ CNTS	B- CNTS	TOTAL B CNTS	ORF CNTS	OLR CNTS	SPEED-RF KM/HR•	SPEED-LR KM/HR•
3686.5	71	6	65	247	169	78	15045	15256	6.6	8.6
3687.5	71	6	65	247	169	78	15049	15260	6.8	6.8
3688.6	71	6	65	247	169	78	15053	15264	6.8	6.8
3689.6	71	6	65	247	169	78	15056	15266	5.1	6.8
3690.6	71	6	65	247	169	78	15059	15271	5.1	5.1
3691.6	71	6	65	247	169	78	15063	15274	6.8	5.1
3692.7	71	6	65	247	169	78	15067	15278	6.8	6.8
3693.7	71	6	65	247	169	78	15071	15283	6.8	8.6
3694.7	71	6	65	247	169	78	15076	15288	8.6	8.6
3695.7	71	6	65	247	169	78	15081	15293	8.6	8.6
3696.8	71	6	65	247	169	78	15085	15297	6.8	6.8
3697.8	71	6	65	247	169	78	15089	15301	6.8	6.8
3698.8	71	6	65	247	169	78	15093	15305	6.8	6.8
3699.8	71	6	65	247	169	78	15096	15309	5.1	6.8
3700.9	71	6	65	247	169	78	15100	15313	6.8	6.8
3701.9	71	6	65	247	169	78	15104	15317	6.8	6.8
3702.9	71	6	65	247	169	78	15108	15321	6.8	6.8
3703.9	71	6	65	247	169	78	15113	15325	8.6	6.8
3705.0	71	6	65	247	169	78	15118	15329	8.6	6.8
3706.0	71	6	65	247	169	78	15122	15333	6.8	6.8
3707.0	71	6	65	247	169	78	15127	15337	8.6	6.8
3708.0	71	6	65	247	169	78	15132	15341	8.6	6.8
3709.0	71	6	65	247	169	78	15137	15347	8.6	10.3
3710.1	71	6	65	247	169	78	15142	15352	8.6	8.6
3711.1	71	6	65	247	169	78	15148	15357	10.3	8.6
3712.1	71	6	65	247	169	78	15154	15361	10.3	6.8
3713.1	71	6	65	247	169	78	15158	15364	6.8	5.1
3714.2	71	6	65	247	169	78	15162	15367	6.8	5.1
3715.2	71	6	65	247	169	78	15165	15371	5.1	6.8
3716.2	71	6	65	247	169	78	15168	15375	5.1	6.8
3717.2	71	6	65	247	169	78	15172	15379	6.8	6.8
3718.3	71	6	65	247	169	78	15175	15382	5.1	5.1
3719.3	71	6	65	247	169	78	15178	15387	5.1	8.6
3720.3	71	6	65	247	169	78	15182	15391	6.8	6.8
3721.3	71	6	65	247	169	78	15185	15395	5.1	6.8
3722.4	71	6	65	247	169	78	15189	15399	6.8	6.8
3723.4	71	6	65	247	169	78	15192	15403	5.1	6.8
3724.4	71	6	65	247	169	78	15196	15406	6.8	5.1
3725.4	71	6	65	247	169	78	15200	15410	6.8	6.8
3726.5	71	6	65	247	169	78	15203	15414	5.1	6.8
3727.5	71	6	65	247	169	78	15207	15417	6.8	5.1
3728.5	71	6	65	247	169	78	15211	15421	6.8	6.8
3729.5	72	6	66	244	169	78	15215	15426	6.8	8.6
3730.5	72	6	66	247	169	78	15220	15431	8.6	8.6
3731.6	72	6	66	247	169	78	15225	15436	8.6	8.6
3732.6	72	6	66	247	169	78	15229	15441	6.8	8.6
3733.6	72	6	66	247	170	77	15234	15446	8.6	8.6
3734.6	72	6	66	247	170	77	15238	15450	6.8	6.8
3735.7	72	6	66	247	170	77	15243	15455	8.6	8.6
3736.7	72	6	66	247	170	77	15248	15459	8.6	6.8
3737.7	72	6	66	247	170	77	15253	15464	8.6	8.6
3738.7	72	6	66	247	170	77	15258	15469	8.6	8.6
3739.8	72	6	66	247	170	77	15264	15475	10.3	10.3
3740.8	72	6	66	247	170	77	15269	15480	8.6	8.6
3741.8	72	6	66	247	170	77	15275	15486	10.3	10.3
3742.8	72	6	66	247	170	77	15281	15492	10.3	10.3
3743.9	72	6	66	247	170	77	15286	15497	8.6	8.6
3744.9	72	6	66	247	170	77	15292	15502	10.3	8.6
3745.9	72	6	66	247	170	77	15297	15508	8.6	10.3
3746.9	72	6	66	247	170	77	15303	15513	10.3	8.6

TIME SEC.	R+ CNTS	R- CNTS	TOTAL R CNTS	B+ CNTS	B- CNTS	TOTAL B CNTS	ORF CNTS	OLR CNTS	SPEED-RF KM/HR.	SPEED-LR KM/HR.
3747.9	72	6	66	247	170	77	15310	15519	12.0	10.3
3749.0	72	6	66	247	170	77	15316	15525	10.3	10.3
3750.0	72	6	66	247	170	77	15322	15532	10.3	12.0
3751.0	72	6	66	247	170	77	15328	15539	10.3	12.0
3752.0	72	6	66	247	170	77	15333	15544	8.6	8.6
3753.1	72	6	66	247	170	77	15339	15550	10.3	10.3
3754.1	72	6	66	247	170	77	15345	15556	10.3	10.3
3755.1	72	6	66	247	170	77	15351	15562	10.3	10.3
3756.1	72	6	66	247	170	77	15357	15567	10.3	8.6
3757.2	72	6	66	247	170	77	15362	15571	8.6	6.8
3758.2	72	6	66	247	170	77	15368	15576	10.3	8.6
3759.2	72	6	66	247	170	77	15372	15582	6.8	10.3
3760.2	72	6	66	247	170	77	15376	15587	6.8	8.6
3761.3	72	6	66	247	170	77	15381	15591	8.6	6.8
3762.3	72	6	66	247	170	77	15385	15596	6.8	8.6
3763.3	72	6	66	247	170	77	15390	15600	8.6	6.8
3764.3	72	6	66	247	170	77	15394	15605	6.8	8.6
3765.4	72	6	66	247	170	77	15398	15610	6.8	8.6
3766.4	72	6	66	247	170	77	15402	15614	6.8	6.8
3767.4	72	6	66	247	170	77	15406	15618	6.8	6.8
3768.4	72	6	66	247	170	77	15410	15622	6.8	6.8
3769.4	72	6	66	247	170	77	15414	15626	6.8	6.8
3770.5	72	6	66	247	170	77	15418	15630	6.8	6.8
3771.5	72	6	66	247	170	77	15422	15634	6.8	6.8
3772.5	72	6	66	247	170	77	15426	15639	6.8	8.6
3773.5	72	6	66	247	170	77	15431	15643	8.6	6.8
3774.6	72	6	66	247	170	77	15435	15648	6.8	8.6
3775.6	72	6	66	247	170	77	15439	15653	8.6	8.6
3776.6	72	6	66	247	170	77	15444	15657	8.6	8.6
3777.6	72	6	66	247	170	77	15449	15661	8.6	6.8
3778.7	72	6	66	247	170	77	15452	15665	5.1	6.8
3779.7	72	6	66	247	170	77	15456	15669	6.8	6.8
3780.7	72	6	66	247	170	77	15460	15673	6.8	6.8
3781.7	72	6	66	247	170	77	15465	15677	8.6	6.8
3782.8	72	6	66	247	170	77	15470	15682	8.6	8.6
3783.8	72	6	66	247	170	77	15474	15686	6.8	10.3
3784.8	72	6	66	247	170	77	15479	15693	8.6	8.6
3785.8	72	6	66	247	170	77	15484	15698	8.6	8.6
3786.9	72	6	66	247	170	77	15489	15703	8.6	8.6
3787.9	72	6	66	247	170	77	15494	15708	8.6	8.6
3788.9	72	6	66	247	170	77	15499	15712	8.6	6.8
3789.9	73	6	67	247	170	77	15505	15718	10.3	10.3
3790.9	73	6	67	247	170	77	15510	15723	8.6	8.6
3792.0	73	6	67	247	170	77	15516	15729	10.3	10.3
3793.0	73	6	67	247	170	77	15521	15734	8.6	8.6
3794.0	73	6	67	247	170	77	15526	15740	8.6	10.3
3795.0	73	6	67	247	170	77	15532	15745	10.3	8.6
3796.1	73	6	67	247	170	77	15538	15751	10.3	10.3
3797.1	73	6	67	247	170	77	15544	15757	10.3	10.3
3798.1	73	6	67	247	170	77	15550	15763	10.3	10.3
3799.1	73	6	67	247	171	76	15556	15770	10.3	12.0
3800.2	73	6	67	247	171	76	15563	15776	12.0	10.3
3801.2	73	6	67	247	171	76	15569	15783	10.3	12.0
3802.2	73	6	67	247	171	76	15577	15790	13.7	12.0
3803.2	73	6	67	247	171	76	15584	15797	12.0	12.0
3804.3	73	6	67	247	171	76	15591	15804	12.0	12.0
3805.3	73	6	67	247	171	76	15597	15811	10.3	12.0
3806.3	73	6	67	247	171	76	15604	15817	12.0	10.3
3807.3	73	6	67	247	171	76	15610	15823	10.3	10.3
3808.4	73	6	67	247	171	76	15616	15829	10.3	10.3

TIME SEC.	R+ CNTS	R- CNTS	TOTAL R CNTS	B+ CNTS	B- CNTS	TOTAL B CNTS	ORF CNTS	OLR CNTS	SPEED-RF KM/HR.	SPEED-LR KM/HR.
3809.4	73	6	67	247	171	76	15623	15836	12.0	12.0
3810.4	73	6	67	247	171	76	15629	15842	10.3	10.3
3811.4	73	6	67	247	171	76	15635	15849	10.3	12.0
3812.4	73	6	67	247	171	76	15642	15856	12.0	12.0
3813.5	73	6	67	247	171	76	15649	15862	12.0	10.3
3814.5	73	6	67	247	171	76	15655	15869	10.3	12.0
3815.5	73	6	67	247	171	76	15662	15875	12.0	10.3
3816.5	73	6	67	247	171	76	15668	15881	10.3	10.3
3817.6	73	6	67	247	171	76	15675	15888	12.0	12.0
3818.6	73	6	67	247	171	76	15681	15894	10.3	10.3
3819.6	73	6	67	247	171	76	15687	15901	10.3	12.0
3820.6	73	6	67	247	171	76	15693	15907	10.3	10.3
3821.7	73	6	67	247	171	76	15699	15913	10.3	10.3
3822.7	73	6	67	247	171	76	15704	15919	8.6	10.3
3823.7	73	6	67	247	171	76	15709	15924	8.6	8.6
3824.7	73	6	67	247	171	76	15714	15930	8.6	10.3
3825.8	73	6	67	247	171	76	15720	15936	10.3	10.3
3826.8	73	6	67	247	171	76	15725	15942	8.6	10.3
3827.8	73	6	67	247	171	76	15731	15947	10.3	8.6
3828.8	73	6	67	247	171	76	15737	15952	10.3	8.6
3829.8	73	6	67	247	171	76	15743	15957	10.3	8.6
3830.9	73	6	67	247	171	76	15747	15963	8.6	10.3
3831.9	73	6	67	247	171	76	15752	15968	8.6	8.6
3832.9	73	6	67	247	171	76	15758	15973	10.3	8.6
3833.9	73	6	67	247	171	76	15763	15979	8.6	10.3
3835.0	73	6	67	247	171	76	15768	15984	8.6	8.6
3836.0	73	6	67	247	171	76	15773	15989	8.6	8.6
3837.0	73	6	67	247	171	76	15778	15994	8.6	8.6
3838.0	73	6	67	247	171	76	15783	16000	8.6	10.3
3839.1	73	6	67	247	171	76	15788	16006	8.6	10.3
3840.1	73	6	67	247	171	76	15794	16012	10.3	10.3
3841.1	73	6	67	247	171	76	15799	16018	8.6	10.3
3842.1	73	6	67	247	171	76	15805	16024	10.3	10.3
3843.2	73	6	67	247	171	76	15810	16030	8.6	10.3
3844.2	73	6	67	247	171	76	15815	16035	8.6	8.6
3845.2	73	6	67	247	171	76	15820	16039	6.8	6.8
3846.2	73	6	67	247	171	76	15824	16043	6.8	6.8
3847.3	73	6	67	247	171	76	15828	16047	6.8	6.8
3848.3	73	6	67	247	171	76	15833	16052	8.6	8.6
3849.3	73	6	67	247	172	75	15838	16057	8.6	8.6
3850.3	73	6	67	247	172	75	15843	16062	8.6	8.6
3851.3	73	6	67	247	172	75	15847	16067	6.8	8.6
3852.4	73	6	67	247	172	75	15852	16071	8.6	8.6
3853.4	73	6	67	247	172	75	15856	16075	6.8	6.8
3854.4	73	6	67	247	172	75	15860	16079	6.8	6.8
3855.4	73	6	67	247	172	75	15864	16084	6.8	8.6
3856.5	73	6	67	247	172	75	15869	16088	8.6	6.8
3857.5	73	6	67	247	172	75	15873	16093	6.8	8.6
3858.5	73	6	67	247	172	75	15878	16098	8.6	8.6
3859.5	73	6	67	247	172	75	15882	16102	6.8	6.8
3860.6	73	6	67	247	172	75	15887	16107	8.6	8.6
3861.6	73	6	67	247	172	75	15892	16112	8.6	8.6
3862.6	73	6	67	247	172	75	15897	16117	8.6	8.6
3863.6	73	6	67	247	172	75	15902	16123	8.6	10.3
3864.7	73	6	67	247	172	75	15906	16129	6.8	10.3
3865.7	74	6	68	247	172	75	15911	16133	8.6	6.8
3866.7	74	6	68	247	172	75	15915	16138	6.8	8.6
3867.7	74	6	68	247	172	75	15920	16142	8.6	6.8
3868.8	74	6	68	247	172	75	15924	16146	6.8	6.8
3869.8	74	6	68	247	172	75	15928	16151	6.8	8.6

TIME SEC.	R+ CNTS	R- CNTS	TOTAL R CNTS	B+ CNTS	B- CNTS	TOTAL B CNTS	ORF CNTS	OLR CNTS	SPEED-RF KM/HR.	SPEED-LR KM/HR.
3870.8	74	6	68	247	172	75	15933	16155	8.6	8.6
3871.8	74	6	68	247	172	75	15938	16160	8.6	8.6
3872.8	74	6	68	248	173	75	15943	16165	8.6	8.6
3873.9	74	6	68	249	173	76	15948	16170	8.6	8.6
3874.9	74	6	68	249	173	76	15954	16176	10.3	10.3
3875.9	74	6	68	249	173	76	15960	16182	10.3	10.3
3876.9	74	6	68	249	173	76	15965	16188	8.6	10.3
3878.0	74	6	68	249	173	76	15970	16193	8.6	8.6
3879.0	74	6	68	249	174	75	15975	16199	8.6	10.3
3880.0	74	6	68	249	174	75	15980	16205	8.6	10.3
3881.0	74	6	68	249	174	75	15986	16210	10.3	8.6
3882.1	74	6	68	249	174	75	15991	16216	8.6	10.3
3883.1	74	6	68	249	174	75	15998	16223	12.0	12.0
3884.1	74	6	68	249	174	75	16004	16229	10.3	10.3
3885.1	74	6	68	249	174	75	16011	16236	12.0	12.0
3886.2	74	6	68	249	174	75	16017	16243	10.3	12.0
3887.2	74	6	68	249	174	75	16023	16250	10.3	12.0
3888.2	74	6	68	249	174	75	16029	16255	10.3	8.6
3889.2	74	6	68	249	174	75	16035	16261	10.3	10.3
3890.3	74	6	68	249	174	75	16042	16266	12.0	8.6
3891.3	74	6	68	249	174	75	16047	16272	8.6	10.3
3892.3	74	6	68	249	174	75	16053	16277	10.3	8.6
3893.3	74	6	68	249	174	75	16059	16283	10.3	10.3
3894.3	74	6	68	249	174	75	16064	16289	8.6	10.3
3895.4	74	6	68	249	174	75	16071	16295	12.0	10.3
3896.4	74	6	68	249	174	75	16077	16302	10.3	12.0
3897.4	74	6	68	249	174	75	16084	16308	12.0	10.3
3898.4	74	6	68	249	174	75	16089	16314	8.6	10.3
3899.5	74	6	68	249	174	75	16094	16319	8.6	8.6
3900.5	74	6	68	249	174	75	16100	16324	10.3	8.6
3901.5	74	6	68	249	174	75	16105	16330	8.6	10.3
3902.5	74	6	68	249	174	75	16111	16336	10.3	10.3
3903.6	74	6	68	249	174	75	16117	16342	10.3	10.3
3904.6	74	6	68	249	174	75	16123	16349	10.3	12.0
3905.6	74	6	68	249	174	75	16130	16356	12.0	12.0
3906.6	74	6	68	249	174	75	16136	16362	10.3	10.3
3907.7	74	6	68	249	174	75	16143	16369	12.0	12.0
3908.7	74	6	68	249	175	74	16150	16376	12.0	12.0
3909.7	74	6	68	249	175	74	16157	16383	12.0	12.0
3910.7	74	6	68	249	175	74	16164	16390	12.0	12.0
3911.7	74	6	68	249	175	74	16170	16397	10.3	12.0
3912.8	74	6	68	249	175	74	16177	16404	12.0	12.0
3913.8	74	6	68	249	175	74	16184	16410	12.0	10.3
3914.8	74	6	68	249	175	74	16190	16417	10.3	12.0
3915.8	74	6	68	249	175	74	16197	16424	12.0	12.0
3916.9	75	6	69	249	175	74	16203	16431	10.3	12.0
3917.9	75	6	69	249	175	74	16209	16437	10.3	10.3
3918.9	75	6	69	249	175	74	16215	16443	10.3	10.3
3919.9	75	6	69	249	175	74	16222	16450	12.0	12.0
3921.0	75	6	69	249	175	74	16227	16456	8.6	10.3
3922.0	75	6	69	249	175	74	16233	16462	10.3	10.3
3923.0	75	6	69	249	175	74	16239	16467	10.3	8.6
3924.0	75	6	69	249	175	74	16245	16473	10.3	10.3
3925.1	75	6	69	249	175	74	16251	16478	10.3	8.6
3926.1	75	6	69	249	175	74	16257	16484	10.3	10.3
3927.1	75	6	69	249	175	74	16263	16490	10.3	10.3
3928.1	75	6	69	249	175	74	16270	16497	12.0	12.0
3929.2	75	6	69	249	175	74	16277	16504	12.0	12.0
3930.2	75	6	69	249	175	74	16283	16510	12.0	10.3
3931.2	75	6	69	249	175	74	16291	16516	12.0	10.3

TIME SEC.	R+ CNTS	R- CNTS	TOTAL R CNTS	B+ CNTS	B- CNTS	TOTAL B CNTS	ORF CNTS	OLR CNTS	SPEED-RF LH/LR.	SPEED-LR LH/LR.
3932.2	75	6	69	249	175	74	16297	16520	10.3	8.8
3933.2	75	6	69	249	175	74	16303	16525	10.3	8.6
3934.3	75	6	69	249	175	74	16308	16530	8.6	8.6
3935.3	75	6	69	249	175	74	16314	16536	10.3	10.3
3936.3	75	6	69	249	175	74	16321	16543	12.0	12.0
3937.3	75	6	69	249	175	74	16326	16549	8.6	10.3
3938.4	75	6	69	249	175	74	16331	16555	8.6	10.3
3939.4	75	6	69	249	175	74	16336	16560	8.6	8.6
3940.4	75	6	69	249	175	74	16341	16564	8.6	6.8
3941.4	75	6	69	250	175	75	16346	16570	8.6	10.3
3942.5	75	6	69	250	175	75	16352	16575	10.3	8.6
3943.5	75	6	69	250	175	75	16356	16581	10.3	10.3
3944.5	75	6	69	250	175	75	16363	16587	8.6	10.3
3945.5	75	6	69	250	175	75	16369	16594	10.3	12.0
3946.6	75	6	69	250	175	75	16376	16600	12.0	10.3
3947.6	75	6	69	250	175	75	16382	16606	10.3	10.3
3948.6	75	6	69	250	176	74	16389	16613	12.0	12.0
3949.6	75	6	69	250	176	74	16395	16619	10.3	10.3
3950.7	75	6	69	250	176	74	16402	16624	12.0	8.6
3951.7	75	6	69	250	176	74	16408	16630	10.3	10.3
3952.7	75	6	69	250	176	74	16415	16637	12.0	12.0
3953.7	75	6	69	250	176	74	16420	16642	8.6	8.6
3954.7	75	6	69	250	176	74	16426	16649	10.3	12.0
3955.8	75	6	69	250	176	74	16432	16654	10.3	8.6
3956.8	75	6	69	250	176	74	16437	16660	8.6	10.3
3957.8	75	6	69	250	176	74	16442	16666	8.6	10.3
3958.8	75	6	69	250	176	74	16447	16672	8.6	10.3
3959.9	75	6	69	250	176	74	16453	16678	10.3	10.3
3960.9	75	6	69	250	176	74	16458	16683	8.6	8.6
3961.9	75	6	69	250	176	74	16463	16689	8.6	10.3
3962.9	75	6	69	250	176	74	16468	16694	8.6	8.6
3964.0	75	6	69	250	176	74	16474	16700	10.3	10.3
3965.0	75	6	69	250	176	74	16480	16706	10.3	10.3
3966.0	75	6	69	250	176	74	16486	16713	10.3	12.0
3967.0	75	6	69	250	176	74	16492	16719	10.3	10.3
3968.1	75	6	69	250	176	74	16498	16726	10.3	12.0
3969.1	75	6	69	250	176	74	16504	16732	10.3	10.3
3970.1	75	6	69	250	176	74	16510	16739	10.3	12.0
3971.1	75	6	69	250	176	74	16516	16745	10.3	10.3
3972.2	76	6	70	250	176	74	16522	16750	10.3	8.6
3973.2	76	6	70	250	176	74	16528	16756	10.3	10.3
3974.2	76	6	70	250	176	74	16533	16761	8.6	8.6
3975.2	76	6	70	250	176	74	16539	16765	10.3	6.8
3976.2	76	6	70	250	176	74	16543	16769	6.8	6.8
3977.3	76	6	70	250	176	74	16547	16773	6.8	6.8
3978.3	76	6	70	250	176	74	16552	16778	8.6	8.6
3979.3	76	6	70	250	176	74	16558	16784	10.3	10.3
3980.3	76	6	70	250	177	73	16562	16788	6.8	6.8
3981.4	76	6	70	250	177	73	16567	16793	8.6	8.6
3982.4	76	6	70	250	177	73	16573	16799	10.3	10.3
3983.4	76	6	70	250	177	73	16578	16804	8.6	8.6
3984.4	76	6	70	250	177	73	16583	16809	8.6	8.6
3985.5	76	6	70	250	177	73	16588	16814	8.6	8.6
3986.5	76	6	70	250	177	73	16593	16818	8.6	6.8
3987.5	76	6	70	250	177	73	16598	16822	8.6	6.8
3988.5	76	6	70	250	177	73	16602	16826	6.8	6.8
3989.6	76	6	70	250	177	73	16606	16831	6.8	8.6
3990.6	76	6	70	250	177	73	16610	16836	6.8	8.6
3991.6	76	6	70	250	177	73	16614	16841	6.8	8.6
3992.6	76	6	70	250	177	73	16619	16846	8.6	8.6

TIME SEC.	R+ CNTS	R- CNTS	TOTAL R CNTS	B+ CNTS	B- CNTS	TOTAL B CNTS	ORF CNTS	OLR CNTS	SPEED-RF KM/HR.	SPEED-H KM/HR.
3993.6	76	6	70	251	178	73	16624	16851	8.6	8.6
3994.7	76	6	70	252	178	74	16629	16856	8.6	8.6
3995.7	76	6	70	252	178	74	16634	16860	8.6	6.8
3996.7	76	6	70	252	178	74	16638	16865	6.8	8.6
3997.7	76	6	70	252	178	74	16642	16869	6.8	6.8
3998.6	76	6	70	252	178	74	16646	16873	6.8	6.8
3999.8	76	6	70	252	178	74	16650	16877	6.8	6.8
4000.8	76	6	70	252	178	74	16655	16882	8.6	8.6
4001.8	76	6	70	252	178	74	16660	16887	8.6	8.6
4002.9	76	6	70	252	178	74	16665	16892	8.6	8.6
4003.9	76	6	70	252	178	74	16670	16897	8.6	8.6
4004.9	76	6	70	252	178	74	16675	16902	8.6	8.6
4005.9	76	6	70	252	178	74	16680	16907	8.6	8.6
4007.0	76	6	70	252	178	74	16683	16911	5.1	6.8
4008.0	76	6	70	252	178	74	16688	16915	8.6	6.8
4009.0	76	6	70	252	178	74	16692	16920	6.8	8.6
4010.0	76	6	70	252	178	74	16696	16924	6.8	8.6
4011.1	76	6	70	252	178	74	16700	16930	6.8	10.3
4012.1	76	6	70	252	178	74	16704	16935	6.8	8.6
4013.1	76	6	70	252	178	74	16708	16940	6.8	8.6
4014.1	76	6	70	252	178	74	16713	16944	8.6	6.8
4015.1	76	6	70	252	178	74	16718	16949	8.6	8.6
4016.2	76	6	70	252	178	74	16723	16954	8.6	8.6
4017.2	76	6	70	252	178	74	16728	16958	8.6	6.8
4018.2	76	6	70	252	178	74	16732	16963	6.8	8.6
4019.2	76	6	70	252	178	74	16737	16967	8.6	6.8
4020.3	76	6	70	252	178	74	16742	16972	8.6	8.6
4021.3	76	6	70	252	178	74	16746	16976	6.8	8.6
4022.3	76	6	70	252	178	74	16751	16980	8.6	6.8
4023.3	76	6	70	252	178	74	16756	16985	8.6	8.6
4024.4	76	6	70	252	178	74	16761	16989	8.6	6.8
4025.4	76	6	70	252	178	74	16766	16994	8.6	8.6
4026.4	76	6	70	252	178	74	16770	16999	6.8	8.6
4027.4	76	6	70	252	178	74	16776	17004	10.3	8.6
4028.5	76	6	70	252	178	74	16781	17011	8.6	12.0
4029.5	76	6	70	252	179	73	16787	17017	10.3	10.3
4030.5	76	6	70	252	179	73	16793	17022	10.3	8.6
4031.5	77	6	71	252	179	73	16799	17028	10.3	10.3
4032.6	77	6	71	252	179	73	16805	17033	10.3	8.6
4033.6	77	6	71	252	179	73	16810	17039	8.6	10.3
4034.6	77	6	71	252	179	73	16816	17044	10.3	8.6
4035.6	77	6	71	252	179	73	16821	17049	8.6	8.6
4036.6	77	6	71	252	179	73	16826	17054	8.6	8.6
4037.7	77	6	71	252	179	73	16831	17059	8.6	8.6
4038.7	77	6	71	252	179	73	16836	17064	8.6	8.6
4039.7	77	6	71	252	179	73	16842	17069	10.3	8.6
4040.7	77	6	71	252	179	73	16847	17075	8.6	10.3
4041.8	77	6	71	252	179	73	16853	17080	10.3	8.6
4042.8	77	6	71	252	179	73	16858	17086	8.6	10.3
4043.8	77	6	71	252	179	73	16863	17092	8.6	10.3
4044.8	77	6	71	252	179	73	16867	17097	6.8	8.6
4045.9	77	6	71	252	179	73	16871	17102	6.8	8.6
4046.9	77	6	71	252	179	73	16876	17106	8.6	6.8
4047.9	77	6	71	252	179	73	16880	17111	6.8	8.6
4048.9	77	6	71	252	179	73	16883	17115	5.1	6.8
4050.0	77	6	71	252	179	73	16888	17119	8.6	6.8
4051.0	77	6	71	252	179	73	16892	17124	6.8	8.6
4052.0	77	6	71	252	179	73	16896	17128	6.8	6.8
4053.0	77	6	71	252	179	73	16901	17133	8.6	8.6
4054.1	77	6	71	252	179	73	16906	17138	8.6	8.6

TIME SEC.	R+ CNTS	R- CNTS	TOTAL R CNTS	B+ CNTS	B- CNTS	TOTAL B CNTS	ORF CNTS	OLR CNTS	SPEED-RF KM/HR.	SPEED-L KM/HR.
4055.1	77	6	71	252	179	73	16911	17144	8.6	10.3
4056.1	77	6	71	252	179	73	16916	17149	8.6	8.6
4057.1	77	6	71	252	179	73	16921	17155	8.6	10.3
4058.1	77	6	71	252	179	73	16927	17161	10.3	10.3
4059.2	77	6	71	252	179	73	16932	17166	8.6	8.6
4060.2	77	6	71	252	179	73	16937	17172	8.6	10.3
4061.2	77	6	71	252	179	73	16943	17176	10.3	8.6
4062.2	77	6	71	252	179	73	16947	17181	6.8	8.6
4063.3	77	6	71	252	179	73	16951	17186	6.8	8.6
4064.3	77	6	71	252	179	73	16955	17190	6.8	6.8
4065.3	77	6	71	252	179	73	16960	17195	8.6	8.6
4066.3	77	6	71	252	179	73	16964	17200	6.8	8.6
4067.4	77	6	71	252	179	73	16969	17205	8.6	8.6
4068.4	77	6	71	252	179	73	16975	17210	10.3	8.6
4069.4	77	6	71	252	179	73	16980	17215	8.6	8.6
4070.4	77	6	71	252	179	73	16985	17220	8.6	8.6
4071.5	77	6	71	252	179	73	16990	17225	8.6	8.6
4072.5	77	6	71	252	179	73	16995	17229	8.6	6.8
4073.5	77	6	71	252	179	73	16999	17234	6.8	8.6
4074.5	77	6	71	252	179	73	17004	17238	8.6	8.6
4075.5	77	6	71	252	179	73	17009	17243	8.6	8.6
4076.6	77	6	71	252	179	73	17014	17247	8.6	6.8
4077.6	77	6	71	252	179	73	17019	17251	8.6	6.8
4078.6	77	6	71	252	180	72	17024	17256	8.6	8.6
4079.6	77	6	71	252	80	72	17028	17262	6.8	10.3
4080.7	77	6	71	252	180	72	17032	17266	6.8	6.8
4081.7	77	6	71	252	180	72	17037	17271	8.6	8.6
4082.7	77	6	71	252	180	72	17042	17276	8.6	8.6
4083.7	77	6	71	252	180	72	17046	17281	6.8	8.6
4084.8	77	6	71	252	180	72	17051	17286	8.6	8.6
4085.8	77	6	71	252	180	72	17056	17291	8.6	8.6
4086.8	77	6	71	252	180	72	17062	17297	10.3	10.3
4087.8	77	6	71	252	180	72	17067	17302	8.6	8.6
4088.9	77	6	71	253	181	72	17071	17306	6.8	6.8
4089.9	77	6	71	254	181	73	17075	17311	6.8	8.6
4090.9	77	6	71	254	181	73	17080	17316	8.6	8.6
4091.9	77	6	71	254	181	73	17084	17320	6.8	6.8
4093.0	78	6	72	254	181	73	17090	17325	10.3	8.6
4094.0	78	6	72	254	181	73	17095	17329	8.6	8.6
4095.0	78	6	72	254	181	73	17100	17334	8.6	8.6
4096.0	78	6	72	254	181	73	17105	17339	8.6	8.6
4097.0	78	6	72	254	181	73	17109	17344	6.8	8.6
4098.1	78	6	72	254	181	73	17115	17349	10.3	8.6
4099.1	78	6	72	254	181	73	17120	17354	8.6	8.6
4100.1	78	6	72	254	181	73	17126	17359	10.3	8.6
4101.1	78	6	72	254	181	73	17132	17365	10.3	10.3
4102.2	78	6	72	254	181	73	17138	17371	10.3	10.3
4103.2	78	6	72	254	181	73	17143	17376	8.6	8.6
4104.2	78	6	72	254	181	73	17147	17381	6.8	8.6
4105.2	78	6	72	254	181	73	17151	17386	6.8	8.6
4106.3	78	6	72	254	181	73	17156	17390	8.6	8.6
4107.3	78	6	72	254	181	73	17160	17394	6.8	6.8
4108.3	78	6	72	254	181	73	17165	17398	8.6	6.8
4109.3	78	6	72	254	181	73	17170	17403	8.6	8.6
4110.4	78	6	72	254	181	73	17175	17408	8.6	8.6
4111.4	78	6	72	254	181	73	17180	17413	8.6	8.6
4112.4	78	6	72	254	181	73	17185	17418	8.6	8.6
4113.4	78	6	72	254	181	73	17190	17423	8.6	8.6
4114.5	78	6	72	254	181	73	17195	17428	8.6	8.6
4115.5	78	6	72	254	181	73	17200	17432	8.6	6.8

TIME SEC.	R+ CNTS	R- CNTS	TOTAL R CNTS	B+ CNTS	B- CNTS	TOTAL B CNTS	ORF CNTS	OLR CNTS	SPEED-RF KM/HR.	SPEED-L KM/HR.
4116.5	78	6	72	254	182	72	17204	17437	6.8	8.6
4117.5	78	6	72	255	182	73	17208	17440	6.8	5.1
4118.5	78	6	72	255	183	72	17212	17444	6.8	6.8
4119.6	78	6	72	255	183	72	17216	17448	6.8	6.8
4120.6	78	6	72	255	183	72	17220	17454	6.8	10.3
4121.6	78	6	72	255	183	72	17225	17458	8.6	6.8
4122.6	78	6	72	255	183	72	17229	17464	6.8	10.3
4123.7	78	6	72	255	183	72	17234	17468	8.6	6.8
4124.7	78	6	72	255	183	72	17238	17473	6.8	8.6
4125.7	78	6	72	255	183	72	17242	17478	6.8	8.6
4126.7	78	6	72	255	183	72	17247	17482	8.6	6.8
4127.8	78	6	72	255	183	72	17251	17488	6.8	10.3
4128.8	78	6	72	255	183	72	17256	17492	8.6	6.8
4129.8	78	6	72	255	183	72	17261	17497	8.6	8.6
4130.8	78	6	72	255	183	72	17266	17503	8.6	10.3
4131.9	78	6	72	255	183	72	17272	17508	10.3	8.6
4132.9	78	6	72	255	183	72	17277	17514	8.6	10.3
4133.9	78	6	72	255	183	72	17283	17518	10.3	6.8
4134.9	78	6	72	255	183	72	17288	17523	8.6	8.6
4136.0	78	6	72	255	183	72	17292	17528	6.8	8.6
4137.0	78	6	72	255	183	72	17297	17532	8.6	6.8
4138.0	78	6	72	255	183	72	17301	17538	6.8	10.3
4139.0	78	6	72	255	183	72	17305	17542	6.8	6.8
4140.0	78	6	72	255	183	72	17309	17547	6.8	8.6
4141.1	78	6	72	255	183	72	17314	17551	8.6	6.8
4142.1	78	6	72	255	183	72	17318	17557	6.8	10.3
4143.1	78	6	72	255	183	72	17324	17562	10.3	8.6
4144.1	78	6	72	255	183	72	17329	17568	8.6	10.3
4145.2	78	6	72	255	183	72	17335	17574	10.3	10.3
4146.2	78	6	72	255	183	72	17340	17580	8.6	10.3
4147.2	78	6	72	255	183	72	17346	17585	10.3	8.6
4148.2	79	6	73	255	183	72	17351	17591	8.6	10.3
4149.3	79	6	73	255	183	72	17356	17596	8.6	8.6
4150.3	79	6	73	255	183	72	17361	17601	8.6	8.6
4151.3	79	6	73	255	183	72	17365	17606	6.8	8.6
4152.3	79	6	73	255	183	72	17369	17611	6.8	8.6
4153.4	79	6	73	255	183	72	17374	17615	8.6	6.8
4154.4	79	6	73	255	183	72	17378	17620	6.8	8.6
4155.4	79	6	73	255	183	72	17384	17625	10.3	8.6
4156.4	79	6	73	255	183	72	17389	17629	8.6	6.8
4157.4	79	6	73	255	183	72	17393	17633	6.8	6.8
4158.5	79	6	73	255	183	72	17396	17636	5.1	5.1
4159.5	79	6	73	255	183	72	17400	17639	6.8	5.1
4160.5	79	6	73	255	183	72	17403	17643	5.1	6.8
4161.5	79	6	73	255	183	72	17407	17647	6.8	6.8
4162.6	79	6	73	255	183	72	17412	17652	8.6	8.6
4163.6	79	6	73	255	183	72	17417	17657	8.6	8.6
4164.6	79	6	73	255	183	72	17421	17662	6.8	8.6
4165.6	79	6	73	255	183	72	17426	17668	8.6	10.3
4166.7	79	6	73	255	183	72	17431	17673	8.6	8.6
4167.7	79	6	73	255	183	72	17436	17679	8.6	10.3
4168.7	79	6	73	255	183	72	17441	17684	8.6	8.6
4169.7	79	6	73	255	183	72	17447	17690	10.3	10.3
4170.8	79	6	73	255	183	72	17452	17696	8.6	10.3
4171.8	79	6	73	255	183	72	17457	17701	8.6	8.6
4172.8	79	6	73	255	183	72	17462	17707	8.6	10.3
4173.8	79	6	73	255	183	72	17467	17712	8.6	8.6
4174.9	79	6	73	255	183	72	17472	17718	8.6	10.3
4175.9	79	6	73	255	183	72	17477	17722	8.6	6.8
4176.9	79	6	73	255	183	72	17482	17727	8.6	8.6

TIME SEC.	R+ CNTS	R- CNTS	TOTAL R CNTS	B+ CNTS	B- CNTS	TOTAL B CNTS	ORF CNTS	OLR CNTS	SPEED-RF KM/HR.	SPEED-L KM/HR.
4177.9	79	6	73	255	183	72	17467	17735	8.6	10.3
4178.9	79	6	73	255	183	72	17492	17738	8.6	8.6
4180.0	79	6	73	255	183	72	17497	17743	8.6	8.6
4181.0	79	6	73	255	183	72	17502	17749	8.6	10.3
4182.0	79	6	73	255	183	72	17507	17754	8.6	8.6
4183.0	79	6	73	255	183	72	17512	17760	8.6	10.3
4184.1	79	6	73	255	183	72	17517	17766	8.6	10.3
4185.1	79	6	73	255	184	71	17523	17771	10.3	8.6
4186.1	79	6	73	255	184	71	17529	17777	10.3	10.3
4187.1	79	6	73	255	184	71	17534	17783	8.6	10.3
4188.2	79	6	73	255	184	71	17540	17787	10.3	6.8
4189.2	79	6	73	255	184	71	17545	17793	8.6	10.3
4190.2	79	6	73	255	184	71	17550	17798	8.6	8.6
4191.2	79	6	73	255	184	71	17555	17803	8.6	8.6
4192.3	79	6	73	255	185	70	17560	17808	8.6	8.6
4193.3	79	6	73	255	185	70	17565	17813	8.6	8.6
4194.3	79	6	73	255	185	70	17569	17819	6.8	10.3
4195.3	79	6	73	255	185	70	17574	17824	8.6	8.6
4196.4	79	6	73	255	185	70	17578	17828	6.8	6.8
4197.4	79	6	73	255	185	70	17582	17832	6.8	6.8
4198.4	79	6	73	255	185	70	17586	17836	6.8	6.8
4199.4	79	6	73	255	185	70	17591	17841	8.6	8.6
4200.4	79	6	73	255	185	70	17597	17845	10.3	6.8
4201.5	79	6	73	256	185	71	17601	17850	6.8	8.6
4202.5	79	6	73	256	185	71	17606	17855	8.6	8.6
4203.5	79	6	73	256	185	71	17611	17861	8.6	10.3
4204.5	79	6	73	256	185	71	17616	17866	8.6	8.6
4205.6	79	6	73	256	185	71	17621	17872	8.6	10.3
4206.6	79	6	73	256	185	71	17626	17878	8.6	10.3
4207.6	79	6	73	256	186	70	17632	17883	10.3	8.6
4208.6	79	6	73	256	186	70	17637	17889	8.6	10.3
4209.7	79	6	73	256	186	70	17642	17893	8.6	6.8
4210.7	79	6	73	256	186	70	17646	17898	6.8	8.6
4211.7	79	6	73	256	186	70	17650	17903	6.8	8.6
4212.7	79	6	73	256	186	70	17655	17907	8.6	6.8
4213.8	79	6	73	256	186	70	17659	17910	6.8	5.1
4214.8	79	6	73	256	186	70	17663	17915	6.8	8.6
4215.8	79	6	73	256	186	70	1766	17920	6.8	8.6
4216.8	79	6	73	256	186	70	176	17925	8.6	8.6
4217.9	79	6	73	256	186	70	1767	17930	8.6	8.6
4218.9	79	6	73	256	186	70	17682	17936	8.6	10.3
4219.9	79	6	73	256	186	70	17687	17941	8.6	8.6
4220.9	79	6	73	256	186	70	17692	17947	8.6	10.3
4221.9	79	6	73	256	186	70	17697	17952	8.6	8.6
4223.0	79	6	73	256	186	70	17702	17957	8.6	8.6
4224.0	79	6	73	256	186	70	17707	17962	8.6	8.6
4225.0	79	6	73	256	186	70	17712	17968	8.6	10.3
4226.0	79	6	73	256	186	70	17717	17972	8.6	6.8
4227.1	79	6	73	256	186	70	17721	17977	6.8	8.6
4228.1	79	6	73	256	186	70	17726	17981	8.6	6.8
4229.1	79	6	73	256	186	70	17731	17986	8.6	8.6
4230.1	79	6	73	256	186	70	17735	17992	6.8	10.3
4231.2	79	6	73	256	186	70	17740	17997	8.6	8.6
4232.2	79	6	73	256	186	70	17744	18002	6.8	8.6
4233.2	79	6	73	256	186	70	17749	18007	8.6	8.6
4234.2	79	6	73	256	186	70	17753	18011	6.8	6.8
4235.3	79	6	73	256	186	70	17757	18015	6.8	6.8
4236.3	79	6	73	256	186	70	17762	18020	8.6	8.6
4237.3	79	6	73	256	186	70	17766	18025	6.8	8.6
4238.3	79	6	73	256	186	70	17771	18030	8.6	8.6

TIME SEC.	R+ CNTS	R- CNTS	TOTAL R CNTS	B+ CNTS	B- CNTS	TOTAL B CNTS	ORF CNTS	OLR CNTS	SPEED-RF KM/HR.	SPEED-LR KM/HR.
4239.3	79	6	73	256	186	70	17777	18036	10.3	10.3
4240.4	79	6	73	256	186	70	17782	18041	8.6	8.6
4241.4	79	6	73	256	186	70	17787	18046	8.6	8.6
4242.4	79	6	73	256	186	70	17791	18050	6.8	6.8
4243.4	79	6	73	256	186	70	17796	18055	8.6	8.6
4244.5	79	6	73	256	186	70	17800	18059	6.8	6.8
4245.5	79	6	73	256	186	70	17805	18064	8.6	8.6
4246.5	79	6	73	256	186	70	17810	18069	8.6	8.6
4247.5	79	6	73	256	186	70	17815	18074	8.6	8.6
4248.6	79	6	73	256	186	70	17819	18078	6.8	6.8
4249.6	79	6	73	256	187	69	17823	18082	6.8	6.8
4250.6	79	6	73	256	187	69	17827	18086	6.8	6.8
4251.6	79	6	73	256	187	69	17830	18090	5.1	6.8
4252.7	79	6	73	256	187	69	17834	18094	6.8	6.8
4253.7	79	6	73	256	187	69	17837	18097	5.1	5.1
4254.7	79	6	73	256	187	69	17841	18101	6.8	6.8
4255.7	79	6	73	256	187	69	17845	18105	6.8	6.8
4256.8	79	6	73	256	187	69	17849	18109	6.8	6.8
4257.8	79	6	73	256	187	69	17853	18113	6.8	6.8
4258.8	79	6	73	256	187	69	17857	18117	6.8	6.8
4259.8	79	6	73	256	187	69	17860	18121	5.1	6.8
4260.8	79	6	73	256	187	69	17864	18125	6.8	6.8
4261.9	79	6	73	256	187	69	17868	18128	6.8	5.1
4262.9	79	6	73	256	187	69	17872	18133	6.8	8.6
4263.9	79	6	73	256	187	69	17876	18138	6.8	8.6
4264.9	79	6	73	256	187	69	17880	18142	6.8	6.8
4266.0	79	6	73	256	187	69	17883	18146	5.1	6.8
4267.0	79	6	73	256	187	69	17887	18150	6.8	6.8
4268.0	79	6	73	256	187	69	17891	18155	6.8	8.6
4269.0	79	6	73	256	187	69	17896	18160	8.6	8.6
4270.1	79	6	73	256	187	69	17900	18166	6.8	10.3
4271.1	79	6	73	256	187	69	17904	18169	6.8	5.1
4272.1	79	6	73	256	187	69	17909	18173	8.6	8.6
4273.1	79	6	73	256	187	69	17913	18177	6.8	6.8
4274.2	79	6	73	256	187	69	17917	18180	6.8	5.1
4275.2	79	6	73	256	187	69	17921	18184	6.8	6.8
4276.2	79	6	73	256	187	69	17925	18187	6.8	5.1
4277.2	79	6	73	256	187	69	17928	18190	5.1	5.1
4278.3	79	6	73	256	187	69	17932	18194	6.8	6.8
4279.3	79	6	73	256	187	69	17935	18198	5.1	6.8
4280.3	79	6	73	257	187	70	17939	18202	6.8	6.8
4281.3	79	6	73	257	187	70	17943	18206	6.8	6.8
4282.3	79	6	73	257	187	70	17947	18210	6.8	6.8
4283.4	79	6	73	257	187	70	17951	18214	6.8	6.8
4284.4	79	6	73	257	187	70	17955	18218	6.8	6.8
4285.4	79	6	73	257	187	70	17958	18223	5.1	8.6
4286.4	79	6	73	257	187	70	17961	18226	5.1	5.1
4287.5	79	6	73	257	187	70	17964	18230	5.1	6.8
4288.5	79	6	73	257	187	70	17968	18235	6.8	8.6
4289.5	79	6	73	257	187	70	17971	18238	5.1	5.1
4290.5	79	6	73	257	187	70	17975	18243	8.8	8.6
4291.6	79	6	73	257	187	70	17979	18247	6.8	6.8
4292.6	79	6	73	257	187	70	17984	18252	8.6	8.6
4293.6	79	6	73	257	187	70	17988	18257	6.8	8.6
4294.6	79	6	73	257	187	70	17993	18262	8.6	8.6
4295.7	79	6	73	257	187	70	17998	18268	8.6	10.3
4296.7	80	6	74	257	187	70	18003	18273	8.6	8.6
4297.7	80	6	74	257	187	70	18009	18279	10.3	10.3
4298.7	80	6	74	257	187	70	18014	18284	8.6	8.6
4299.8	80	6	74	257	187	70	18020	18290	10.3	10.3

TIME SEC.	R+ CNTS	R- CNTS	TOTAL R CNTS	E+ CNTS	E- CNTS	TOTAL E CNTS	ORF CNTS	OLR CNTS	SPEED-RF KM/HR.	SPEED-L KM/HR.
4300.8	80	6	74	257	187	70	18025	18295	8.6	8.6
4301.8	80	6	74	257	187	70	18031	18302	10.3	12.0
4302.8	80	6	74	257	187	70	18037	18307	10.3	8.6
4303.8	80	6	74	257	187	70	18044	18313	12.0	10.3
4304.9	80	6	74	257	187	70	18050	18319	10.3	10.3
4305.9	80	6	74	257	187	70	18057	18325	12.0	10.3
4306.9	80	6	74	257	187	70	18064	18331	12.0	10.3
4307.9	80	6	74	257	187	70	18070	18337	10.3	10.3
4309.0	80	6	74	257	187	70	18077	18343	12.0	10.3
4310.0	80	6	74	257	187	70	18085	18350	13.7	12.0
4311.0	80	6	74	257	187	70	18091	18357	10.3	12.0
4312.0	80	6	74	257	187	70	18097	18364	10.3	12.0
4313.1	80	6	74	257	187	70	18102	18370	8.6	10.3
4314.1	80	6	74	257	187	70	18109	18376	12.0	10.3
4315.1	80	6	74	257	187	70	18115	18382	10.3	10.3
4316.1	80	6	74	257	187	70	18121	18388	10.3	10.3
4317.2	80	6	74	257	187	70	18127	18394	10.3	10.3
4318.2	80	6	74	257	187	70	18133	18400	10.3	10.3
4319.2	80	6	74	257	187	70	18140	18407	12.0	12.0
4320.2	80	6	74	257	187	70	18146	18413	10.3	10.3
4321.2	80	6	74	257	187	70	18152	18419	10.3	10.3
4322.3	80	6	74	257	187	70	18158	18424	10.3	8.6
4323.3	80	6	74	257	187	70	18163	18429	8.6	8.6
4324.3	80	6	74	257	187	70	18168	18434	8.6	8.6
4325.3	80	6	74	257	187	70	18173	18438	8.6	8.6
4326.4	80	6	74	257	187	70	18177	18442	6.8	6.8
4327.4	80	6	74	257	187	70	18181	18446	6.8	6.8
4328.4	80	6	74	257	187	70	18185	18450	6.8	6.8
4329.4	80	6	74	257	187	70	18189	18454	6.8	6.8
4330.5	80	6	74	257	187	70	18193	18458	6.8	6.8
4331.5	80	6	74	257	187	70	18197	18461	6.8	5.1
4332.5	80	6	74	257	187	70	18200	18465	5.1	6.8
4333.5	80	6	74	257	187	70	18204	18469	6.8	6.8
4334.6	80	6	74	257	187	70	18207	18473	5.1	6.8
4335.6	81	6	75	257	187	70	18210	18476	5.1	5.1
4336.6	81	6	75	257	187	70	18213	18480	5.1	6.8
4337.6	81	6	75	257	187	70	18216	18483	5.1	5.1
4338.7	81	6	75	257	187	70	18219	18486	5.1	5.1
4339.7	81	6	75	257	187	70	18222	18489	5.1	5.1
4340.7	81	6	75	257	187	70	18225	18492	5.1	5.1
4341.7	81	6	75	257	187	70	18227	18495	3.4	5.1
4342.7	81	6	75	257	187	70	18229	18498	3.4	5.1
4343.8	81	6	75	257	187	70	18231	18500	3.4	3.4
4344.8	81	6	75	257	187	70	18233	18503	3.4	5.1
4345.8	81	6	75	257	187	70	18235	18505	3.4	3.4
4346.8	81	6	75	257	187	70	18237	18507	3.4	3.4
4347.9	81	6	75	257	187	70	18238	18509	1.7	3.4
4348.9	81	6	75	257	187	70	18240	18511	3.4	3.4
4349.9	81	6	75	257	187	70	18242	18514	3.4	5.1
4350.9	81	6	75	257	187	70	18245	18517	5.1	5.1
4352.0	81	6	75	257	187	70	18247	18520	3.4	5.1
4353.0	81	6	75	257	187	70	18249	18523	3.4	5.1
4354.0	81	6	75	257	187	70	18251	18526	3.4	5.1
4355.0	81	6	75	257	187	70	18253	18529	3.4	5.1
4356.1	81	6	75	257	187	70	18255	18531	3.4	3.4
4357.1	81	6	75	257	187	70	18255	18533	.0	3.4
4358.1	81	6	75	257	187	70	18255	18533	.0	.0
4359.1	81	6	75	257	187	70	18255	18533	.0	.0
4360.2	81	6	75	257	187	70	18255	18533	.0	.0
4361.2	81	6	75	257	187	70	18255	18533	.0	.0

TIME SEC.	R+ CNTS	R- CNTS	TOTAL R CNTS	E+ CNTS	E- CNTS	TOTAL E CNTS	ORF CNTS	OLR CNTS	SPEED-RF KM/HR.	SPEED-L KM/HR.
4362.2	81	6	75	257	187	70	18255	18533	.0	.0
4363.2	81	6	75	257	187	70	18255	18533	.0	.0
4364.2	81	6	75	257	187	70	18256	18533	1.7	.0
4365.3	81	6	75	257	187	70	18256	18533	.0	.0
4366.3	81	6	75	257	187	70	18256	18533	.0	.0
4367.3	81	6	75	257	187	70	18256	18533	.0	.0
4368.3	81	6	75	257	187	70	18256	18533	.0	.0
4369.4	81	6	75	257	187	70	18256	18533	.0	.0
4370.4	81	6	75	257	187	70	18256	18533	.0	.0
4371.4	81	6	75	257	187	70	18256	18533	.0	.0
4372.4	81	6	75	257	187	70	18256	18533	.0	.0
4373.5	81	6	75	257	187	70	18256	18533	.0	.0
4374.5	81	6	75	257	187	70	18256	18533	.0	.0
4375.5	81	6	75	257	187	70	18256	18533	.0	.0
4376.5	81	6	75	257	187	70	18256	18533	.0	.0
4377.6	81	6	75	257	187	70	18256	18533	.0	.0
4378.6	81	6	75	257	187	70	18256	18533	.0	.0
4379.6	81	6	75	257	187	70	18256	18533	.0	.0
4380.6	81	6	75	257	187	70	18256	18533	.0	.0
4381.7	81	6	75	257	187	70	18256	18533	.0	.0
4382.7	81	6	75	257	187	70	18256	18533	.0	.0
4383.7	81	6	75	257	187	70	18256	18533	.0	.0
4384.7	81	6	75	257	187	70	18256	18533	.0	.0
4385.7	81	6	75	257	187	70	18256	18533	.0	.0
4386.8	81	6	75	257	187	70	18256	18533	.0	.0
4387.8	81	6	75	257	187	70	18256	18533	.0	.0
4388.8	81	6	75	257	187	70	18256	18533	.0	.0
4389.8	81	6	75	257	187	70	18256	18533	.0	STN. 2 .0
4390.9	81	6	75	257	187	70	18256	18533	.0	.0
4391.9	81	6	75	257	187	70	18256	18533	.0	.0
4392.9	81	6	75	257	187	70	18256	18533	.0	.0
4393.9	81	6	75	257	187	70	18256	18533	.0	.0
4395.0	81	6	75	257	187	70	18256	18533	.0	.0
4396.0	81	6	75	257	187	70	18256	18533	.0	.0
4397.0	81	6	75	257	187	70	18256	18533	.0	.0
4398.0	81	6	75	257	187	70	18256	18533	.0	.0
4399.1	81	6	75	257	187	70	18256	18533	.0	.0
4400.1	81	6	75	257	187	70	18256	18533	.0	.0
4401.1	81	6	75	257	187	70	18256	18533	.0	.0
4402.1	81	6	75	257	187	70	18256	18533	.0	.0
4403.1	81	6	75	257	187	70	18256	18533	.0	.0
4404.2	81	6	75	257	187	70	18256	18533	.0	.0
4405.2	81	6	75	257	187	70	18256	18533	.0	.0
4406.2	81	6	75	257	187	70	18256	18533	.0	.0
4407.2	81	6	75	257	187	70	18256	18533	.0	.0
4408.3	81	6	75	257	187	70	18256	18533	.0	.0
4409.3	81	6	75	257	187	70	18256	18533	.0	.0
4410.3	81	6	75	257	187	70	18256	18533	.0	.0
4411.3	81	6	75	257	187	70	18256	18533	.0	.0
4412.4	81	6	75	257	187	70	18256	18533	.0	.0
4413.4	81	6	75	257	187	70	18256	18533	.0	.0
4414.4	81	6	75	257	187	70	18256	18533	.0	.0

TABLE # 3: WANDER FACTORS FOR RIGHT FRONT AND LEFT REAR ODOMETERS

RANGE	O_{RF}	O_{LR}
.1	1.07	1.16
.2	.923	.936
.3	.953	.949
.4	.829	.839
.5	.800	.797
.6	.764	.716
.7	.944	.953
.8	.911	.895
.9	.911	.891
1.0	.990	.962
1.1	.927	.911
1.2	.887	.883
1.3	.944	.936
1.4	.944	.940
1.5	.971	.967
1.6	.794	.800
1.7	.931	.923
1.8	.813	.807
1.9	.949	.949
2.0	.875	.879
2.1	.981	.958
2.2	1.015	1.005
2.3	.911	.895
2.4	.861	.853
2.5	.953	.936
2.6	.927	.907
2.7	.779	.767
2.8	.868	.879
2.9	.936	.927
3.0	.535	.528
3.1	.953	.923
3.2	.891	.903
3.3	.953	.931
3.4	.981	.958
3.5	.919	.931
3.6	.940	.923
3.7	.891	.887
3.8	.971	.967
3.9	.931	.931
4.0	.971	.967
4.1	.879	.864
4.2	.723	.734
4.3	.927	.895
4.4	.936	.944
4.5	.936	.931
4.6	.813	.791
4.7	.903	.895
4.8	.990	.967
4.9	.967	.940
5.0	.936	.911
5.1	.936	.945
5.2	.967	.927
5.3	.940	.919
5.4	1.005	.971
5.5	1.005	.985
5.6	.936	.919
5.7	.949	.923
5.8	.468	.460
5.9	.530	.523
6.0	.891	.853
6.1	.944	.940
6.2	.716	.684
6.3	.985	.944
6.4	.915	.891
6.5	.927	.875
6.6	.850	.839
6.7	.718	.711
6.8	.500	.490
6.9	.694	.680
7.0	.639	.637
7.1	.736	.736
7.2	.696	.682
7.3	.781	.767
7.4	.314	.299
7.5	.976	1.000

TABLE #4 COMPARISON OF EVA-II TRAVERSE DATA FROM USGS, VLBI AND SEP-LRV NAVIGATION DATA

STATION	RANGE (Km)			BEARING		
	VLBI	USGS	SEP-LRV NAV DATA	VLBI	USGS	SEP-LRV NAV DATA
EP-4	.500	.538	.508	80.4	80	83
LRV-1	2.603	2.603	2.645	80.9	78	82
LRV-2	3.750	3.729	3.811	81.4	86	83
LRV-3	4.248	4.253	4.325	80.2	87	82
HOLE IN THE WALL	5.638		5.683	79.5		81
STN. #2		7.46	7.6		68	71

FIG. # 1(a) ROVER SPEED EVA-II
COMPUTED FROM AVERAGED ODOMETERS

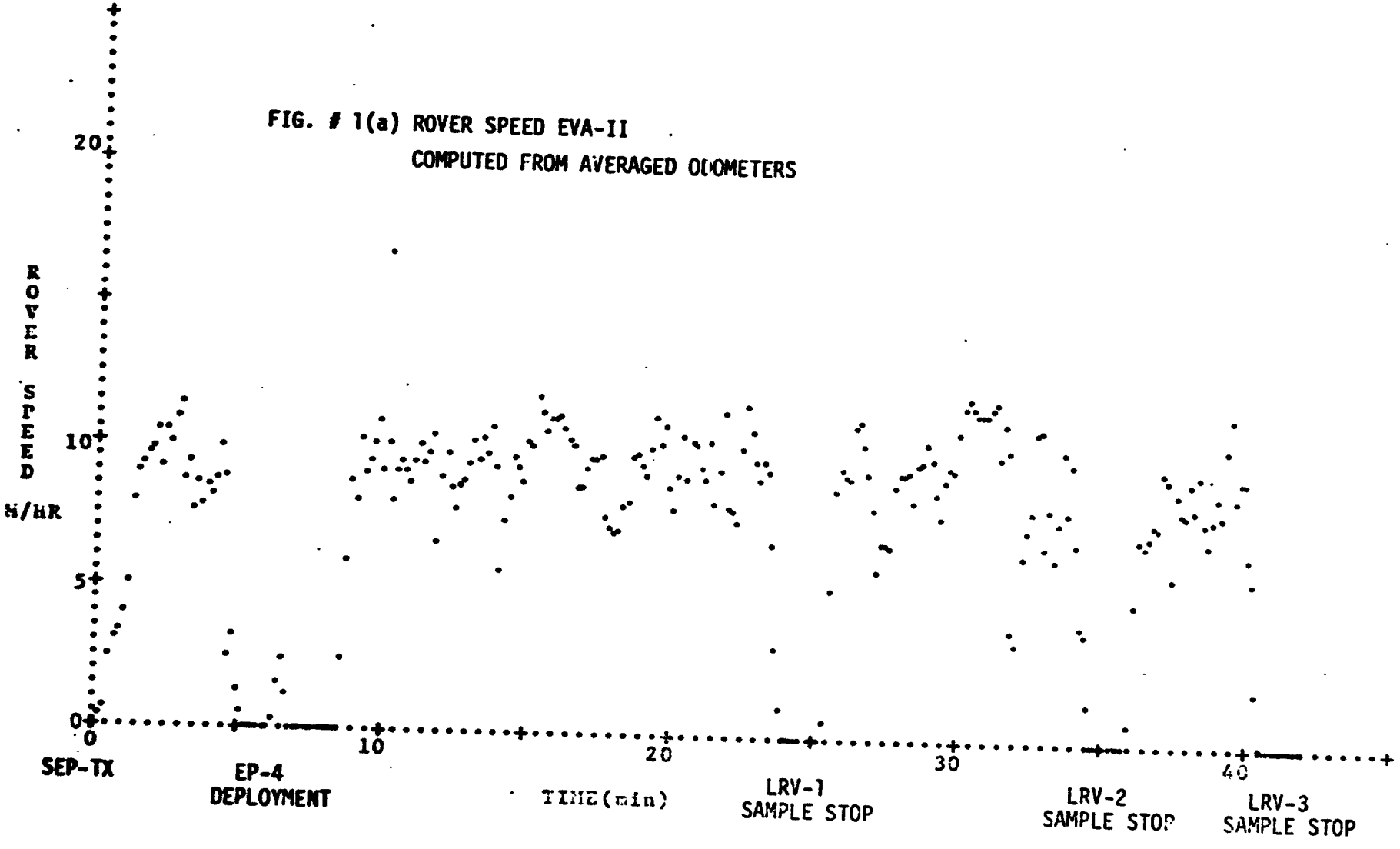


FIG. #1(b) ROVER SPEED EVA-II
COMPUTED FROM AVERAGED ODOMETERS

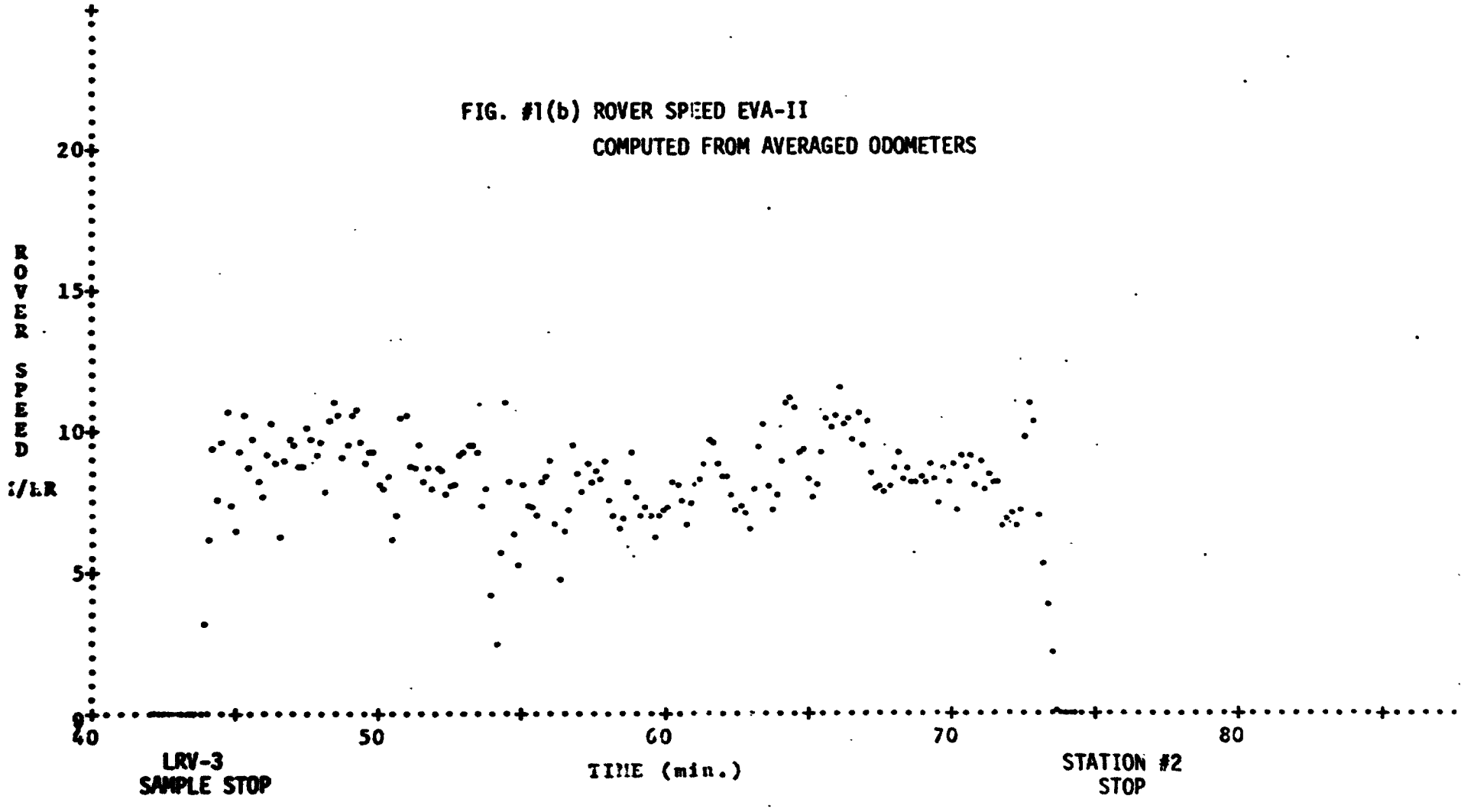


FIG. #2 ROVER SPEED EVA-II

COMPARISON OF SPEED COMPUTED FROM SEPARATE ODOMETERS

$\cdot O_{FF}$

$+O_{LR}$

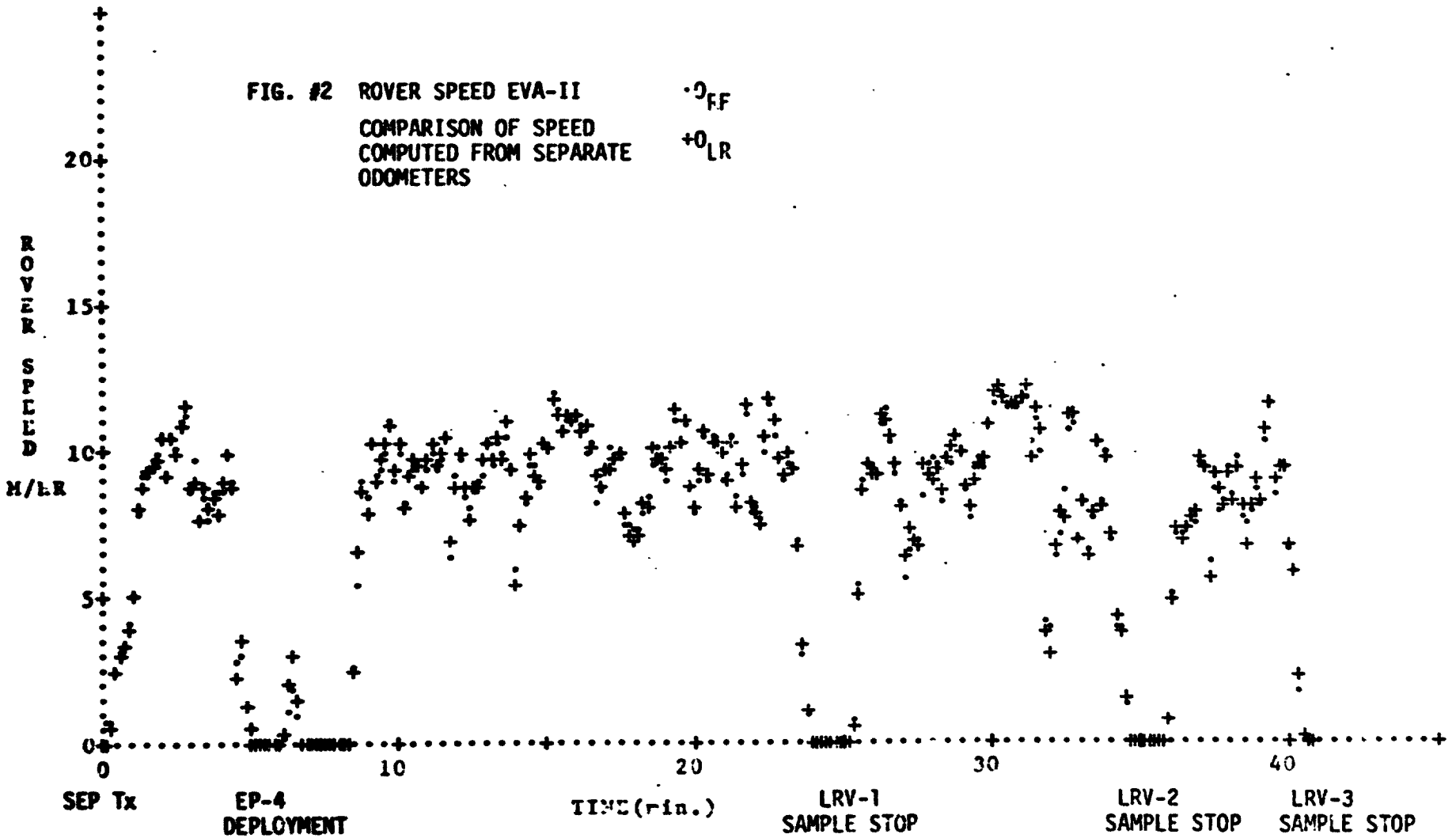


FIG. #3 EVA-II TRAVERSE RECONSTRUCTION FROM SEP-LRV NAVIGATION DATA

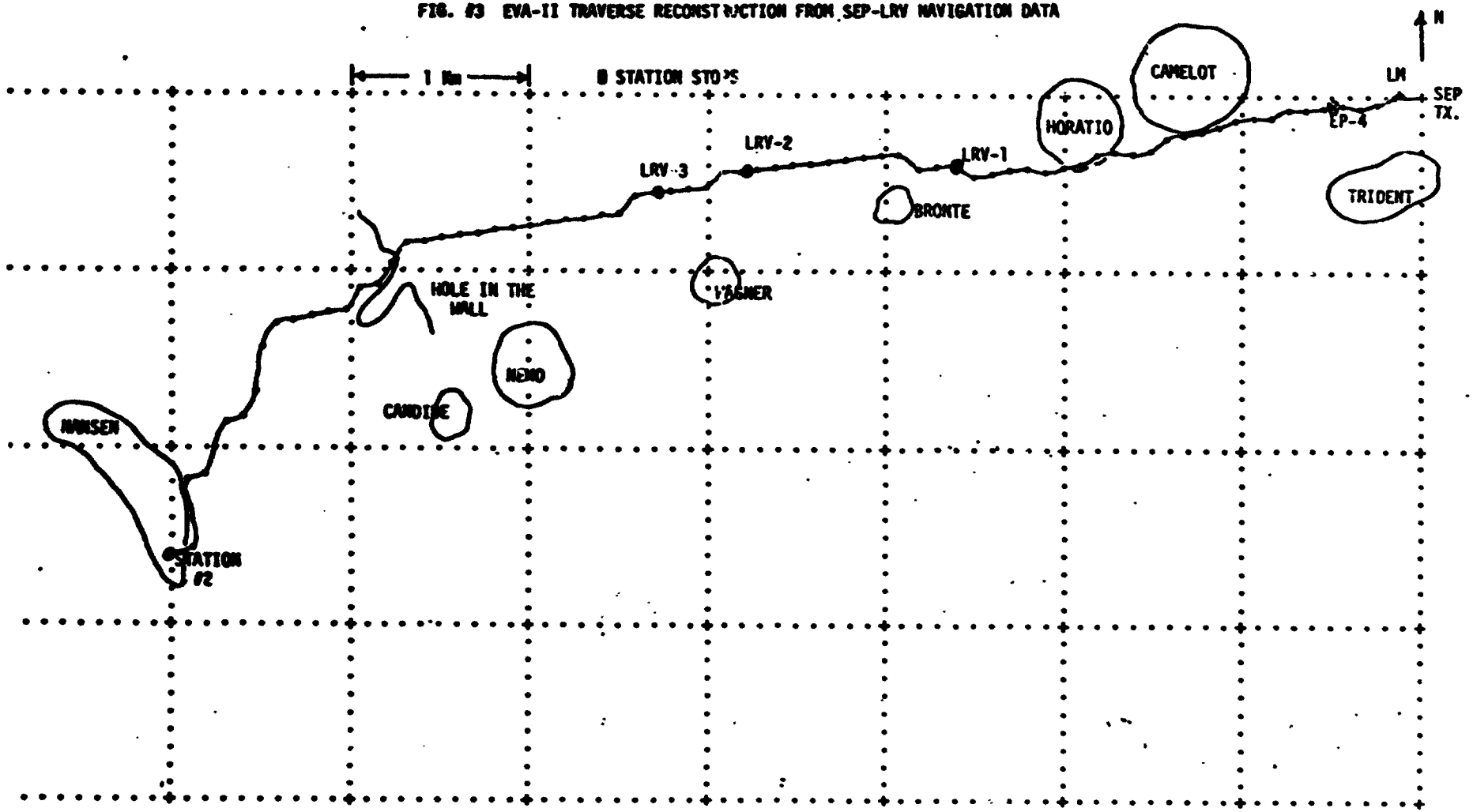


FIG. #4(a) COMPARISON OF EVA-II TRAVERSE RECONSTRUCTION FROM SEP-LRV NAVIGATION DATA WITH VLBI AND USGS TRAVERSE DATA

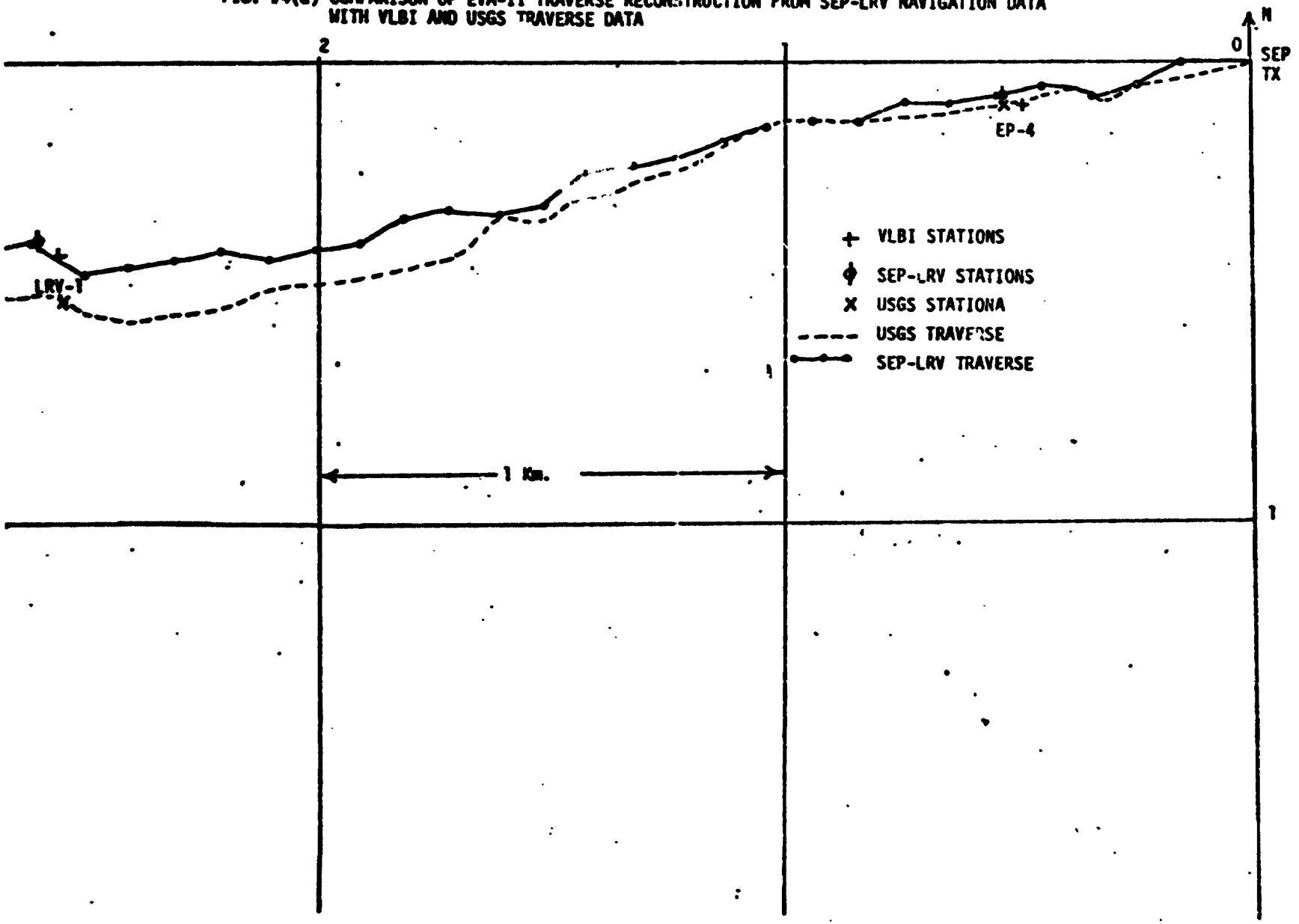
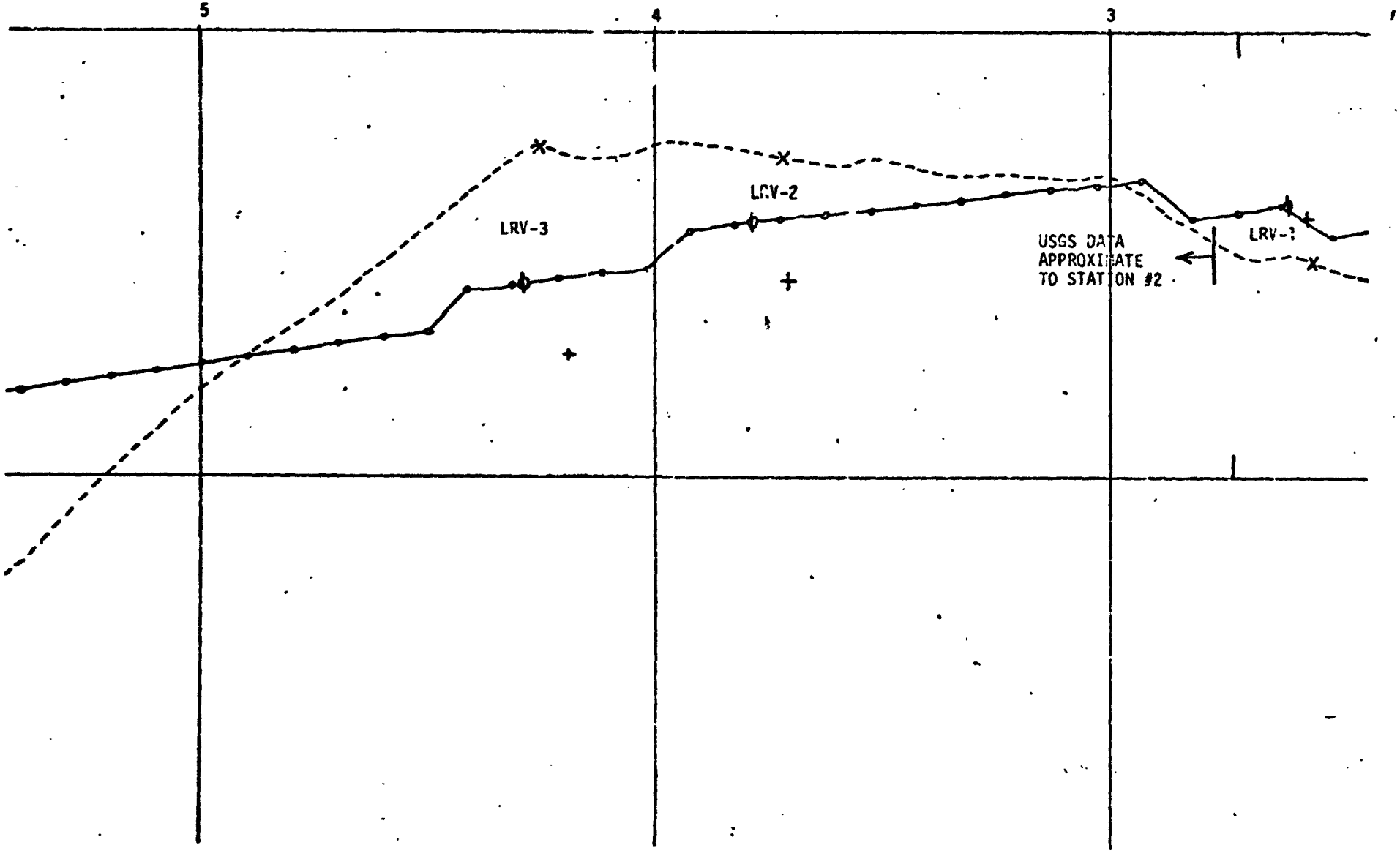


FIG. # 4(b)



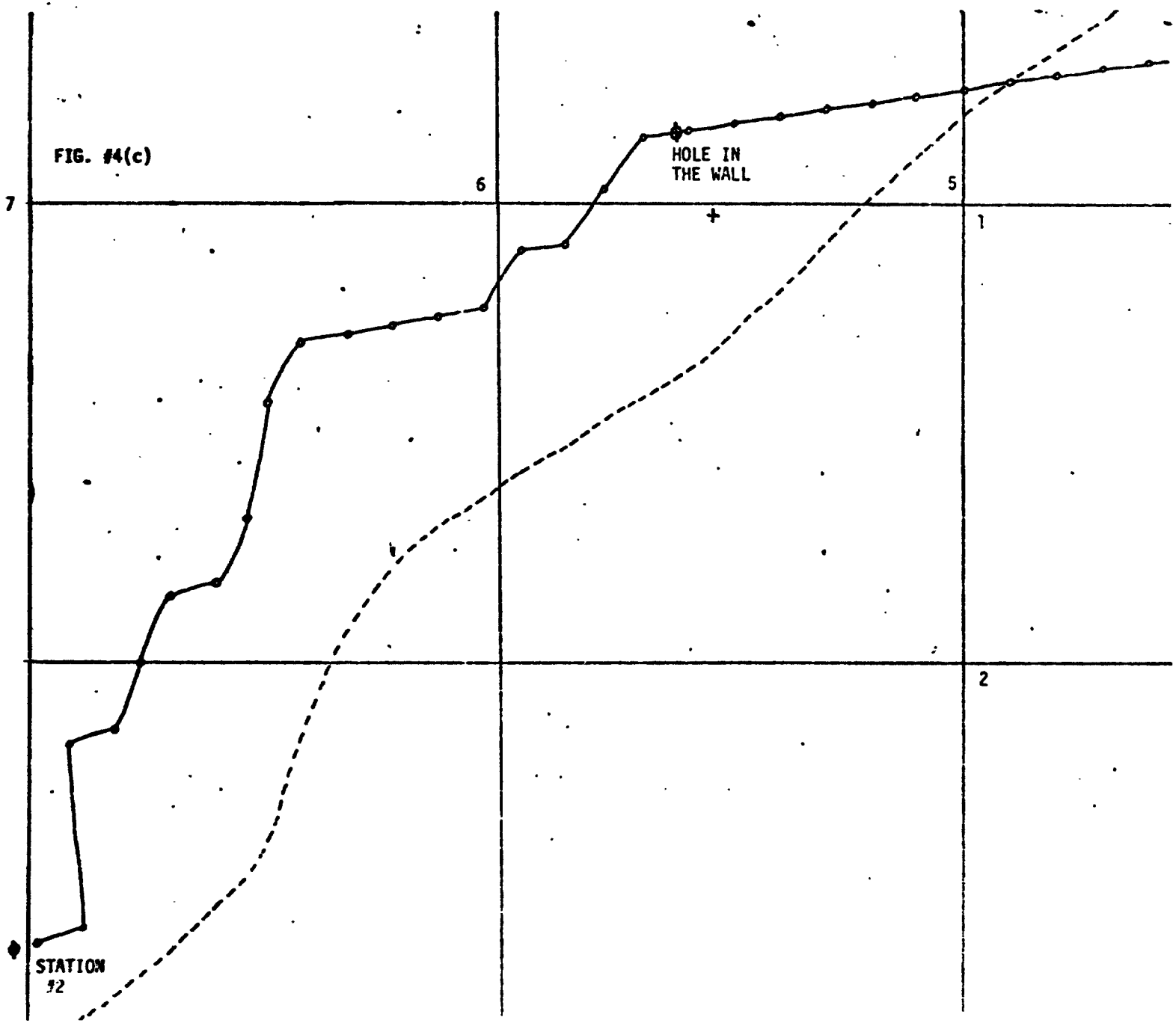
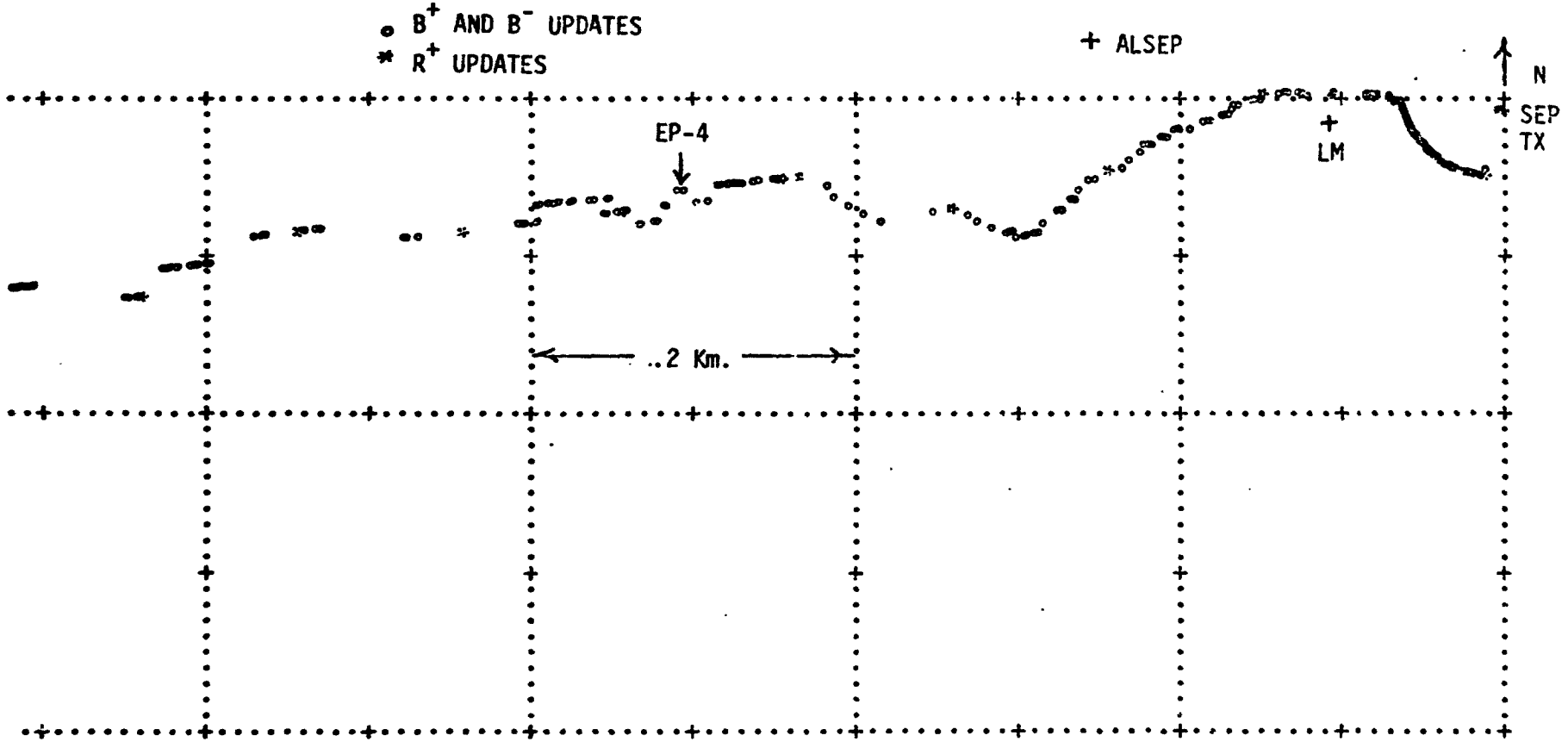


FIG. #4(c)
7
6
5
1
2
HOLE IN
THE WALL
STATION
#2

FIG. #5 EVA-II TRAVERSE



APPENDIX C

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION
MANNED SPACECRAFT CENTER
HOUSTON, TEXAS 77058

REPLY TO
ATTN OF TN2

February 6, 1973

MEMORANDUM

TO: Distribution

FROM: J. D. Redman

SUBJECT: SEP-Data from Station #4 to Station #5

The data that was recorded on the DSEA after station #2 is subject to numerous dropouts and variations in the 5.2 kHz reference frequency. Because of these problems it has been difficult to recover any useful data; however, with more expenditures of time it will be possible to recover a large proportion of the data.

It was not clear whether the receiver was turning on and off under the control of the thermal switch or whether it remained on for the complete run from station #4 to station #5. When the receiver was turned on at station #4 the temperature was reported by the astronauts to be 112°F and at station #5, thirty minutes later it was still at 112°F. The thermal cutoff had been measured during tests on the ground as occurring at 114.5°F for this receiver. It was thought during the mission that the receiver was probably turning off when it reached this thermal cutoff and then on again when it had cooled sufficiently.

All the data from station #2 to the end of the recorded data was recorded on oscillograms at 16 ips to enable a visual inspection of the VCO data. By observing the mode indication and measuring the time between sync frames (nominal 6.48 sec) it was possible to tell if the receiver turned off.

The receiver did turn off at tape time 01:41:12 which corresponds to the turn off at station #2. From that point until the end of the data the receiver did not turn off. The recorded temperature at the beginning of this run was 105°F and at the end 113°F. The receiver was in mode 1 during the complete run and received no reset pulse from the transmitter. The elapsed time from turn off at station #2 to the end of the data was measured using the sync frame in the VCO data as a time reference. This elasped time was 30 minutes 15 seconds. The elapsed time between turn on at station #4 and turn off at station #5 as reported by the astronauts was 30 minutes and 31 seconds.

All this evidence suggests that the receiver was turned on at station #4, that the temperature at that time was misread by the astronauts as 112°F where the data suggests it is 105°F and that the receiver stayed on until station #5 with no resynchronization with the transmitter. The temperature at station #5 reported by the astronauts as 112° agrees with the recorded data which gives a temperature of 113°. The temperature was not read when the receiver was turned on at station #5 but was 112°F when the receiver was turned off at the LEM. It appears that the temperature rose above the cut off of 114.5°F at station #5 and in EVA II it never again cooled below the 108°F required for the receiver to turn on again resulting in no data being recorded for the rest of EVA-II.

Since the receiver did not receive the synchronizing code that is necessary to resync itself with the transmitter the relationship between the transmitter and receiver timing is not known. It is conceivable that if the power levels received from the transmitter were well above the background that a pattern in the received signal strength will allow a determination of this relationship. In any case there is the problem of data dropouts that effects the VCO data and the navigation data. Further investigation and attempts at recovering something meaningful from this data should make it clear whether such attempts are worthwhile in the sense that significant results will be produced.

J. D. Redman

Distribution:
D. W. Strangway
R. D. Watts
D. Cubley
G. Simmons
L. H. Bannister
E. Morrison

APPENDIX D

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION
MANNED SPACECRAFT CENTER
HOUSTON, TEXAS 77058

REPLY TO ATTN OF: TN2

February 6, 1973

MEMORANDUM

TO: Distribution

FROM: J. D. Redman

SUBJECT: SEP Receiver Temperature Data Recorded During EVA-II

All the temperature data recorded on the DSEA tape has been plotted and is shown on two accompanying figures. During the plotting the sample period where the VCO frequency is measured the temperature data was monitored on an oscilloscope which allowed for sample periods that were not entirely within the temperature word to be rejected before plotting. This was particularly important for the data from station #4 to #5 where there are timing problems caused by data dropouts.

The calibration used in plotting the temperature is a straight line fit to the data shown in figure #3.

$$T = .073f - 46.6$$

(T - Temperature °F, f - Frequency in Hertz)

The value of the 5.2 kHz reference frequency is used to help correct for tape speed fluctuations that occurred in the DSEA during recording and playback. During the traverse from station #4 to #5 the 5.2 kHz oscillator frequency changed from 5247 Hz to 5300 Hz. This necessitates corrections being applied to the temperatures shown on the plot in figure #2. The corrected temperature at station #4 is 104°F and at station #5 is 113°F.

The temperature reported by the astronauts at GET 140:46:46 was 80°F. The reading from the SEP data 43 minutes later was 84°F. At station #2 the crew gave a reading of 105°F and the recorded data gave a temperature of 106°F. All these values are quite consistent with one another; however at station #4 the crew read the temperature as 112°F whereas the data gives 104°F. At station #5 the crew reading was

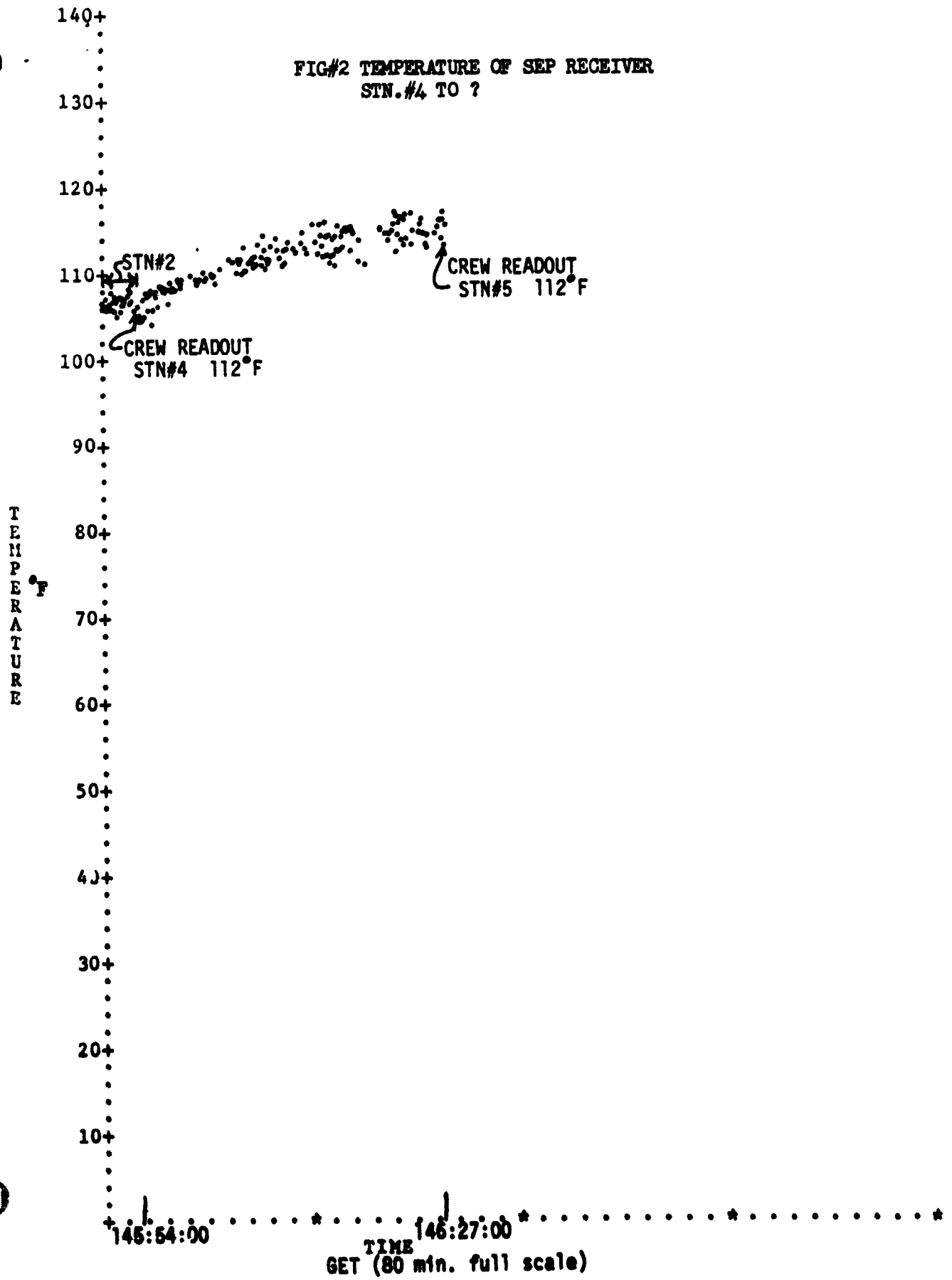
112°F and the data gives 113°F (corrected value). It appears from other arguments explained in the memo "SEP-Data from Station #4 to Station #5" that the discrepancy at station #4 is best explained as a misreading by the crew. Generally there is good agreement for three of the four readings reported by the crew. The instrument appears never to have come on past station 5 and this could well be because the receiver reached its thermal cutoff of 114.5°F and did not cool below the 108°F necessary for it to turn on again during EVA-II.

J. D. Redman

3 Enclosures

Distribution:
D. W. Strangway
R. D. Watts
D. Cubley
G. Simmons
L. H. Bannister
E. Morrison

FIG#2 TEMPERATURE OF SEP RECEIVER
STN.#4 TO ?



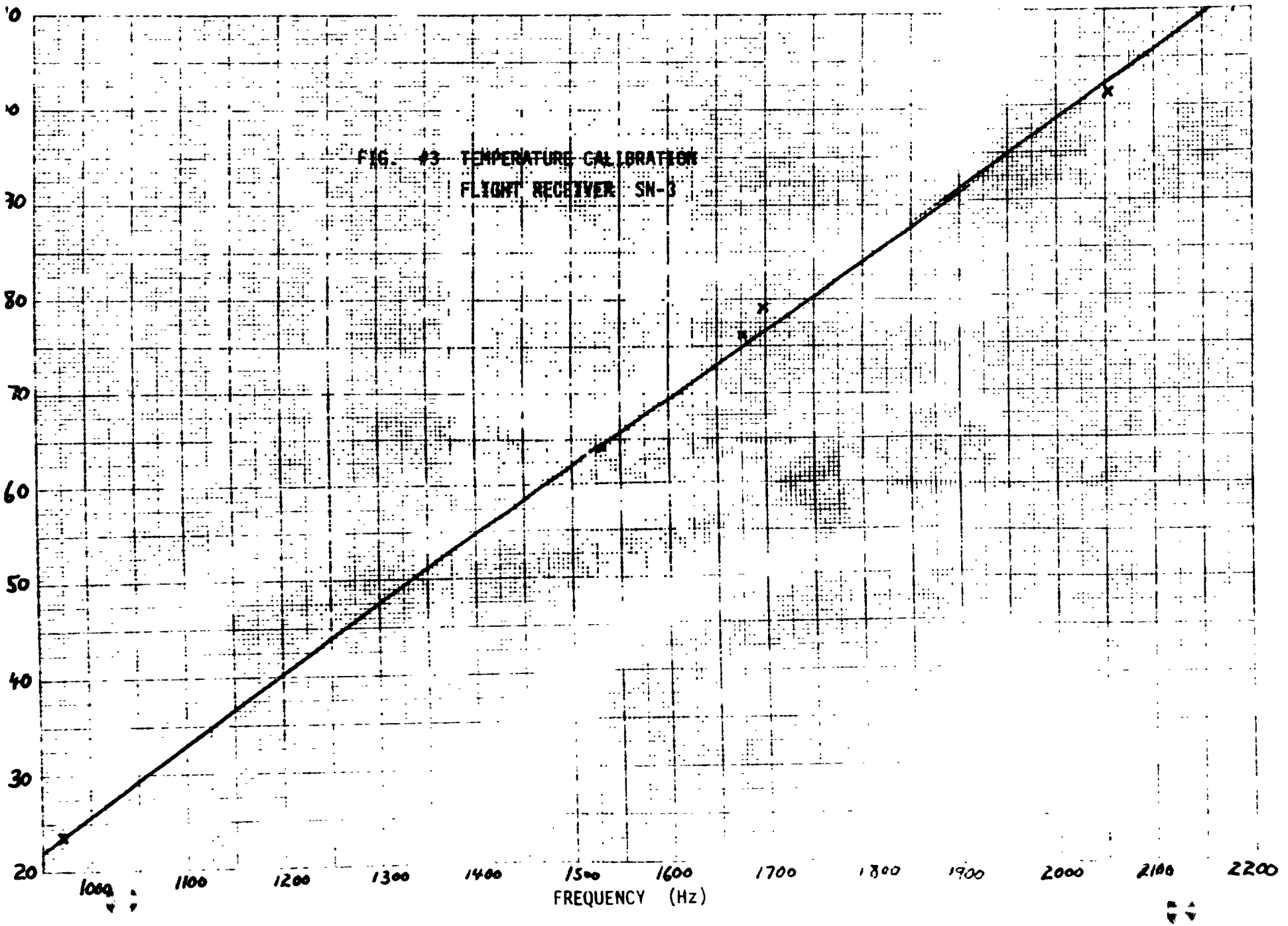
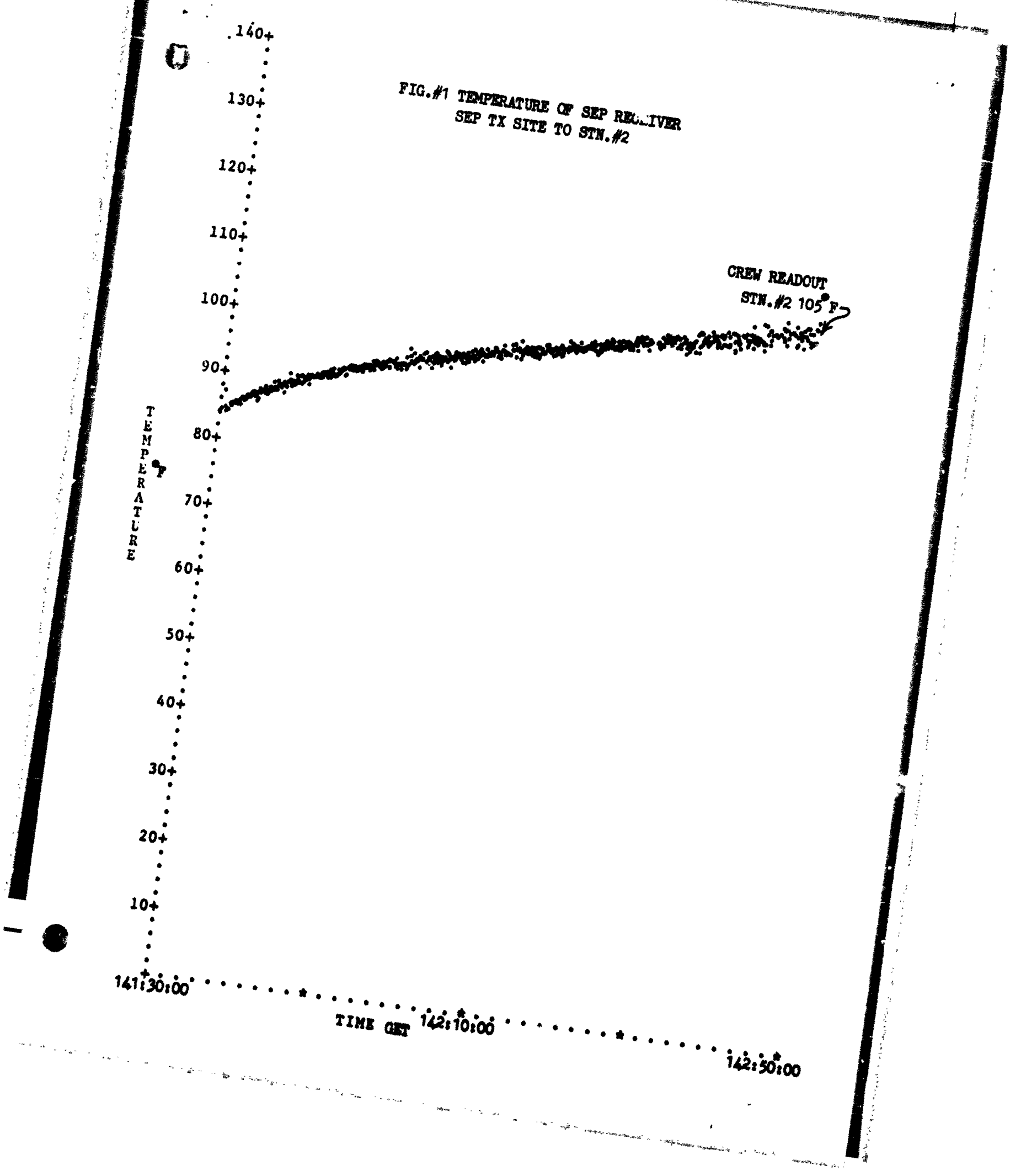


FIG. #3 TEMPERATURE CALIBRATION
FLIGHT RECEIVER SN-3
0
10
20
30
40
50
60
70
80
90
1000
1100
1200
1300
1400
1500
1600
1700
1800
1900
2000
2100
2200
FREQUENCY (Hz)

FIG.#1 TEMPERATURE OF SEP RECEIVER
SEP TX SITE TO STN.#2



APPENDIX E

UNIVERSITIES SPACE RESEARCH ASSOCIATION

THE LUNAR SCIENCE INSTITUTE

MEMORANDUM **DATE:** Dec. 10, 1973

TO: SEP Distribution

FROM: Ray Watts RDW

SUBJECT: DAS Digitizing Accuracy

To evaluate the contribution of the digitizing process to the end-to-end SEP system error, David Redman generated two digital tapes with the Data Acquisition System identically configured. These have been designated SEP402 and SEP403. They are the basis of the final version of SEP lunar data.

The following operations were performed for the error study: all measurements were converted to frequency. Frequency measurements were compared on a one-to-one basis between the two tapes. The average of the two frequency measurements was used to classify the frequency into one of 26 frequency groups spanning the ranges (400-500 Hz., 500-600 Hz., ..., 2900-3000 Hz.). The discrepancy between the two measurements was then used to build an error distribution for each of the frequency groups.

The error values are summarized on the attached line graph. The minimum values clearly occur in the midrange of frequencies, 1-2 KHz. Above 2 KHz., errors increase because the constant number of cycles (5) of the VCO which are measured constitute a very short time interval (1.3 - 2.5 msec.). The granularity of the microsecond timer is not as important an effect as the short-term variations in the DSEA "5200" multivibrator reference oscillator. At lower frequencies, the distorted waveforms recorded by the DSEA cause detection of false or undependable zero-crossings. The distributions indicate that when timing has been repeated exactly, so the same cycles have been counted, then zero error results. A one-cycle shift in the counting frame probably accounts for most of the errors.

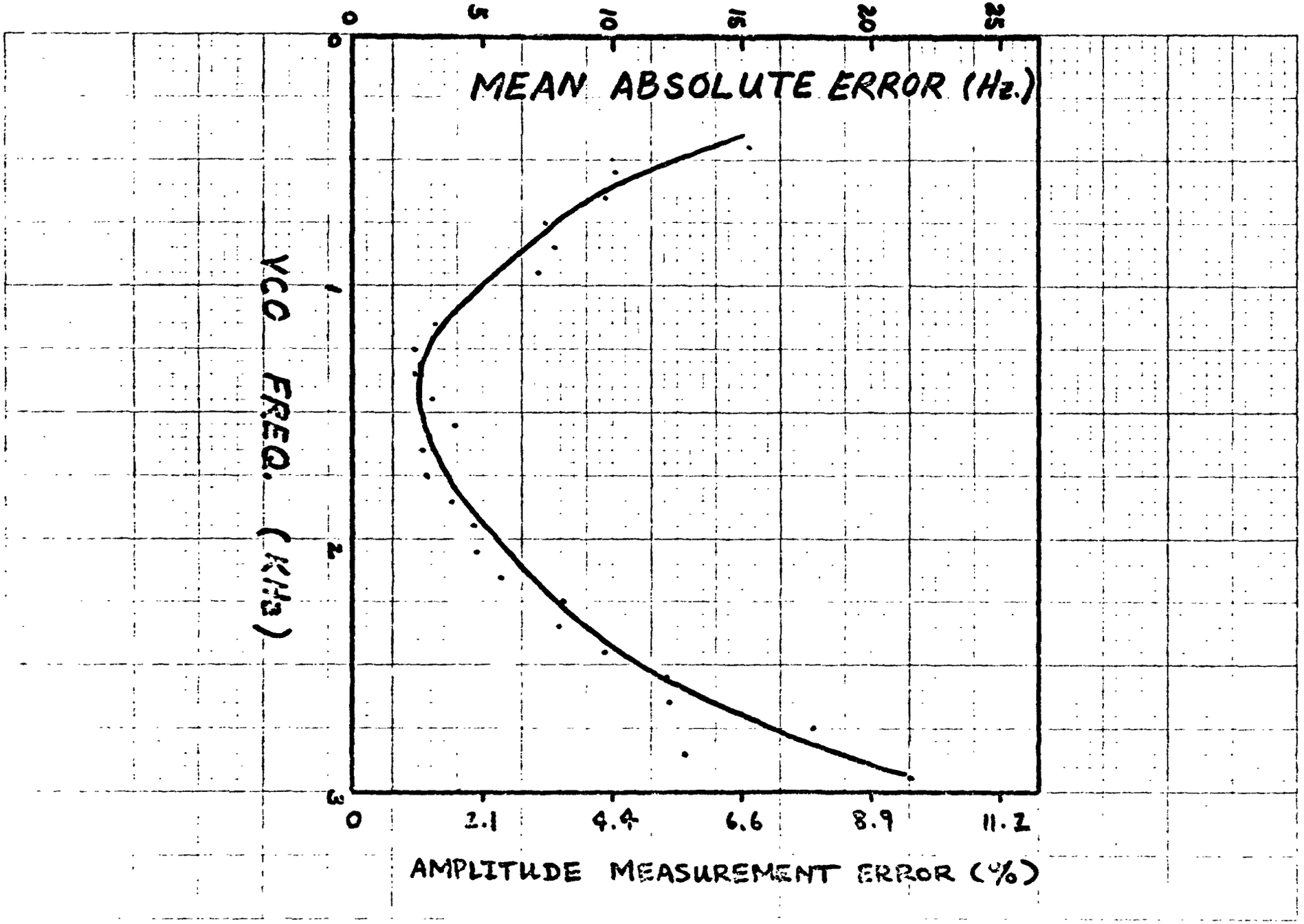
Also shown on the line graph are the amplitude measurement errors corresponding to the frequency errors. These were computed on the basis of a constant 1 dB./27 Hz. calibration assumption for the VCO. The actual situation is somewhat worse, for at the ends of the curve there is a grea

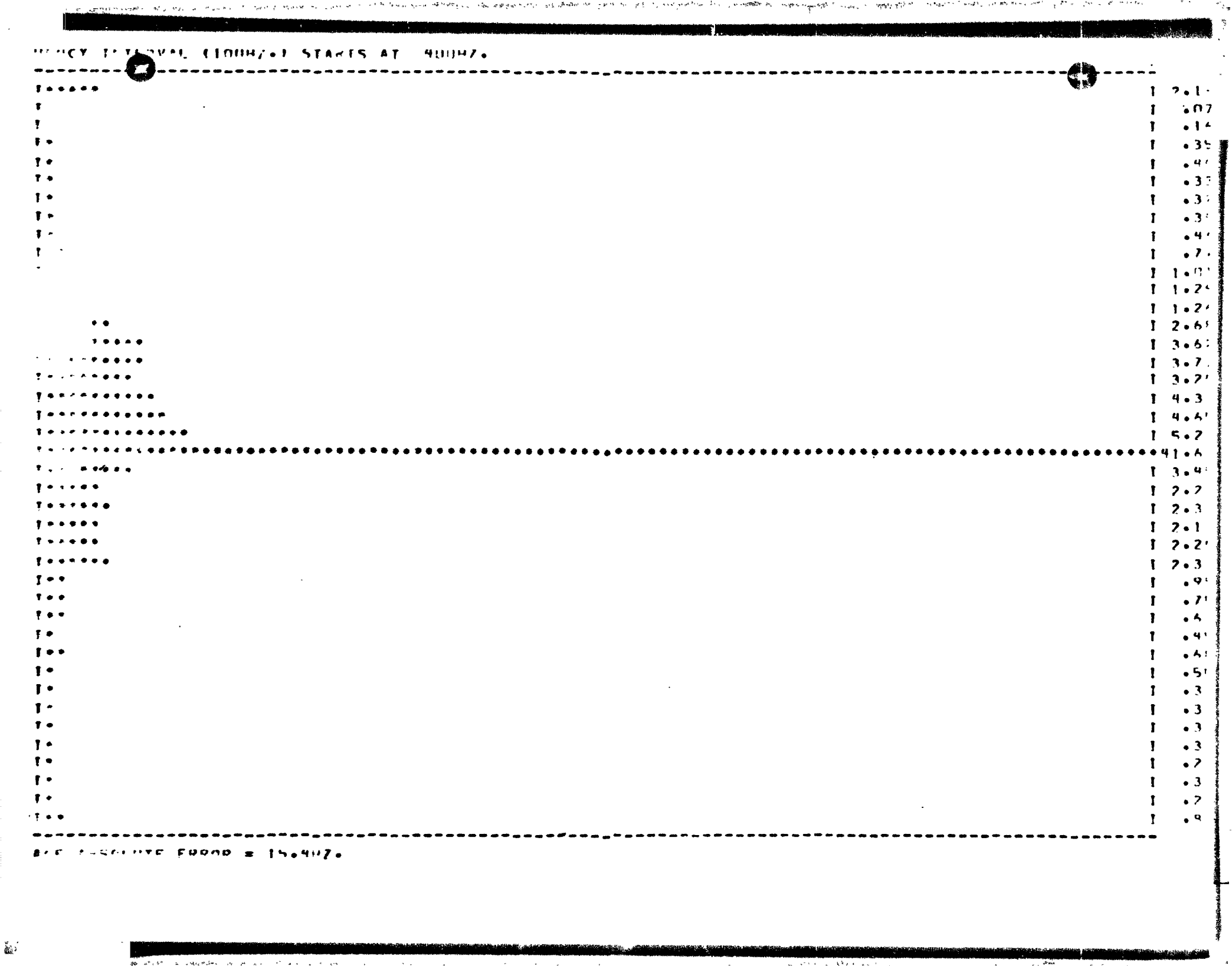
dB. change per Hz. than has been shown. From a computational standpoint, the accuracy of the measurements is quite poor — a sacrifice which was necessary to obtain the desired dynamic range. This level of error (< 1 dB.) is more than adequate for curve matching applications.

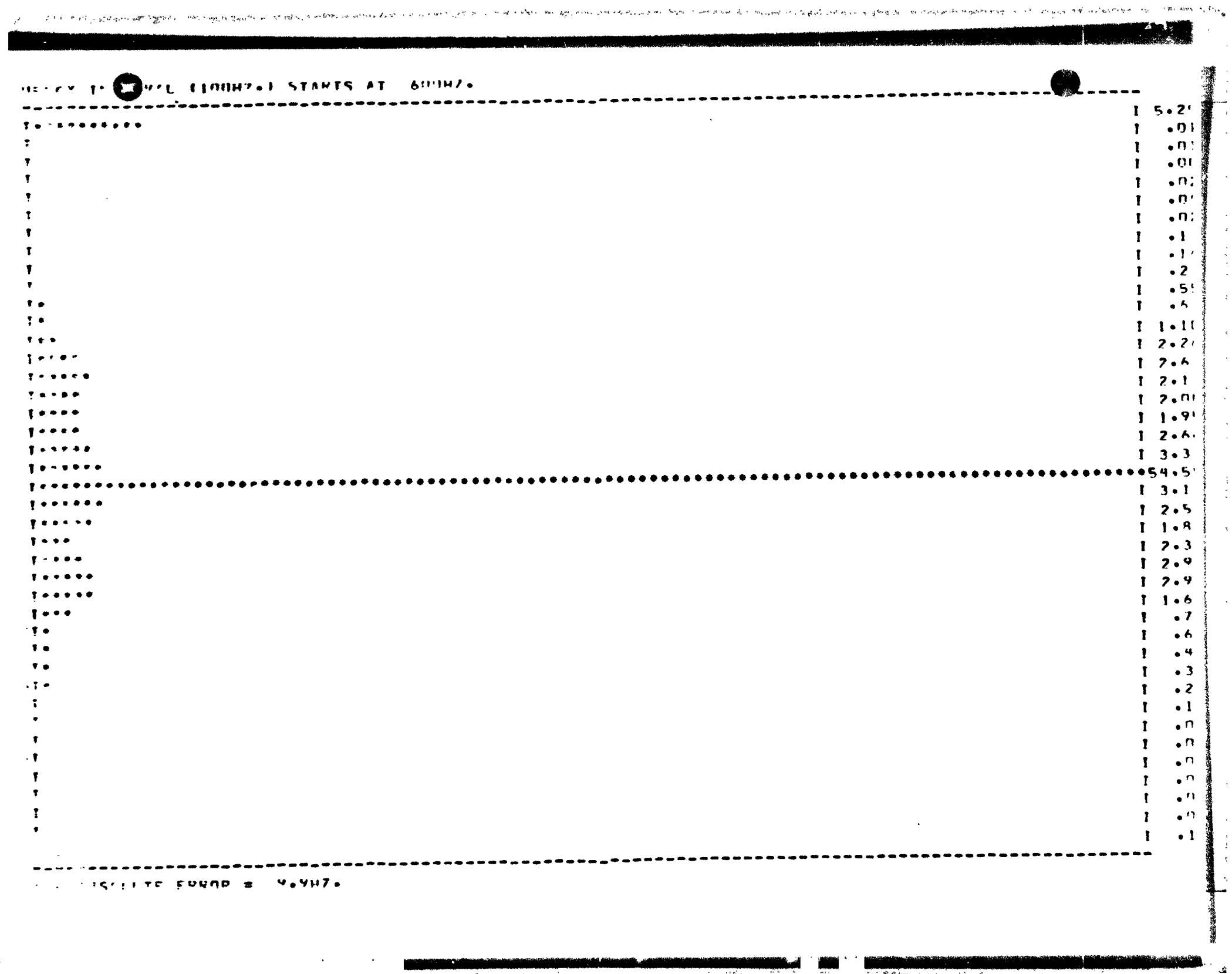
RW:lm

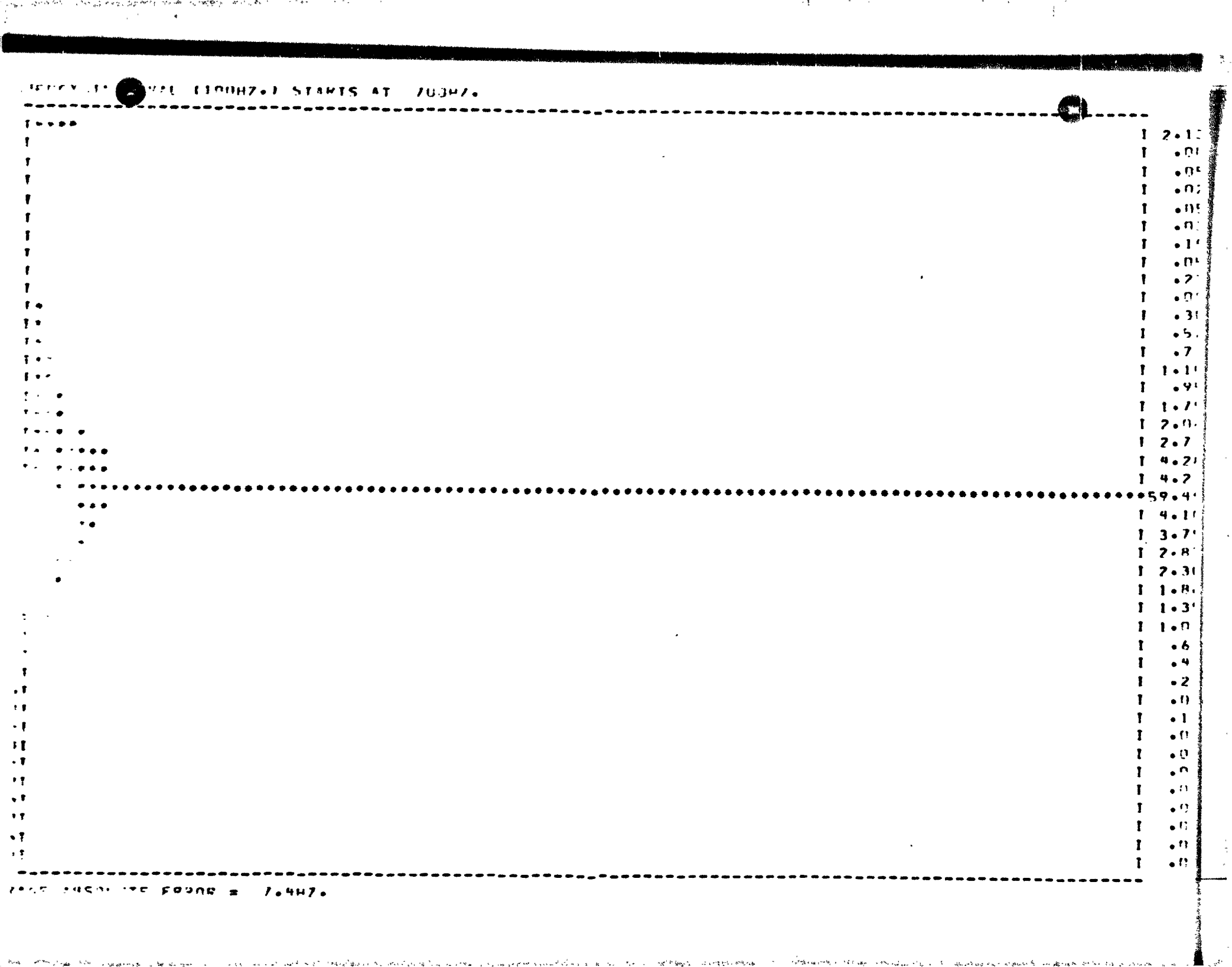
Distribution:

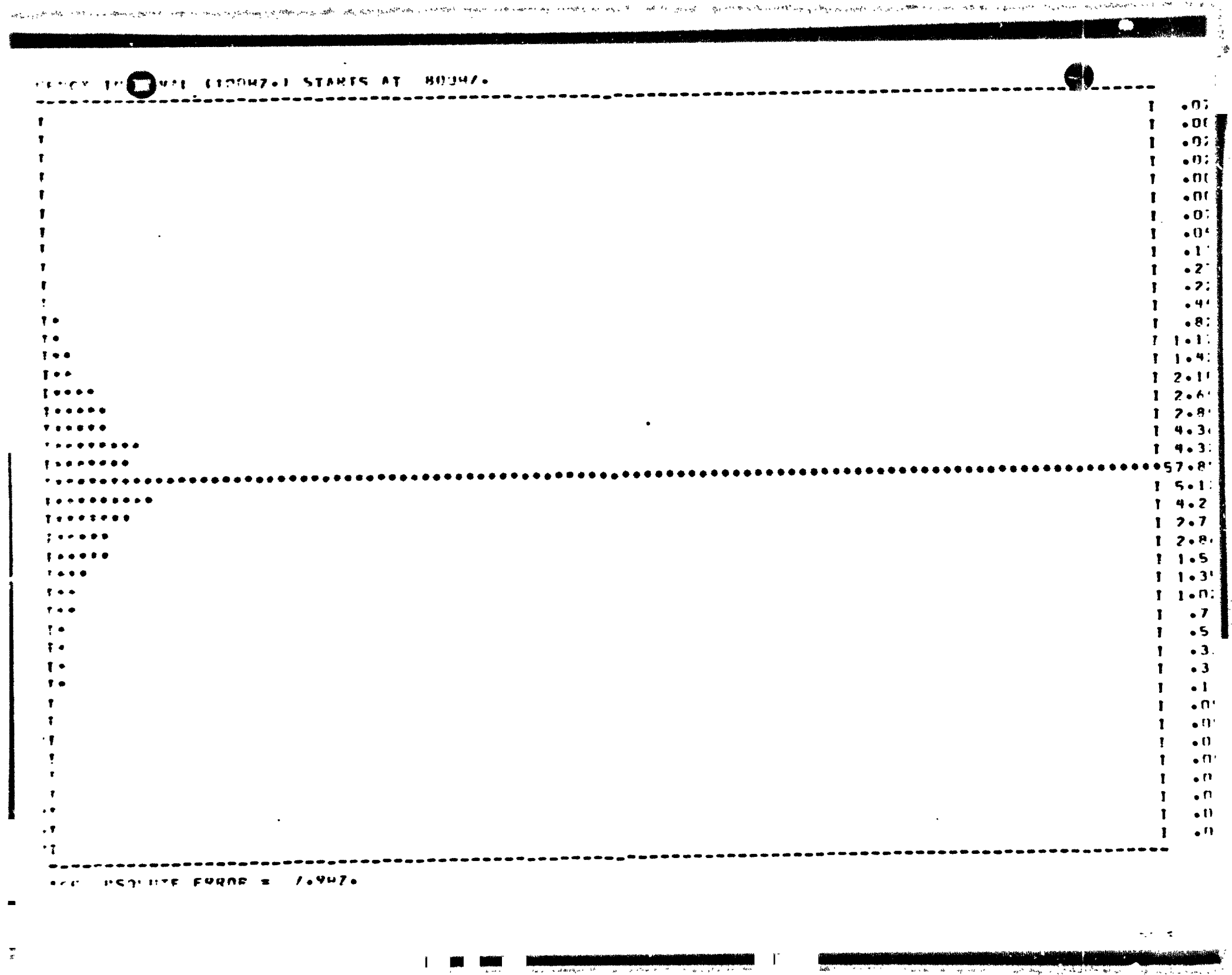
Strangway - Toronto
✓Redman - "
Rossiter - "
Annan - "
Groener - MIT
Simmons - MIT

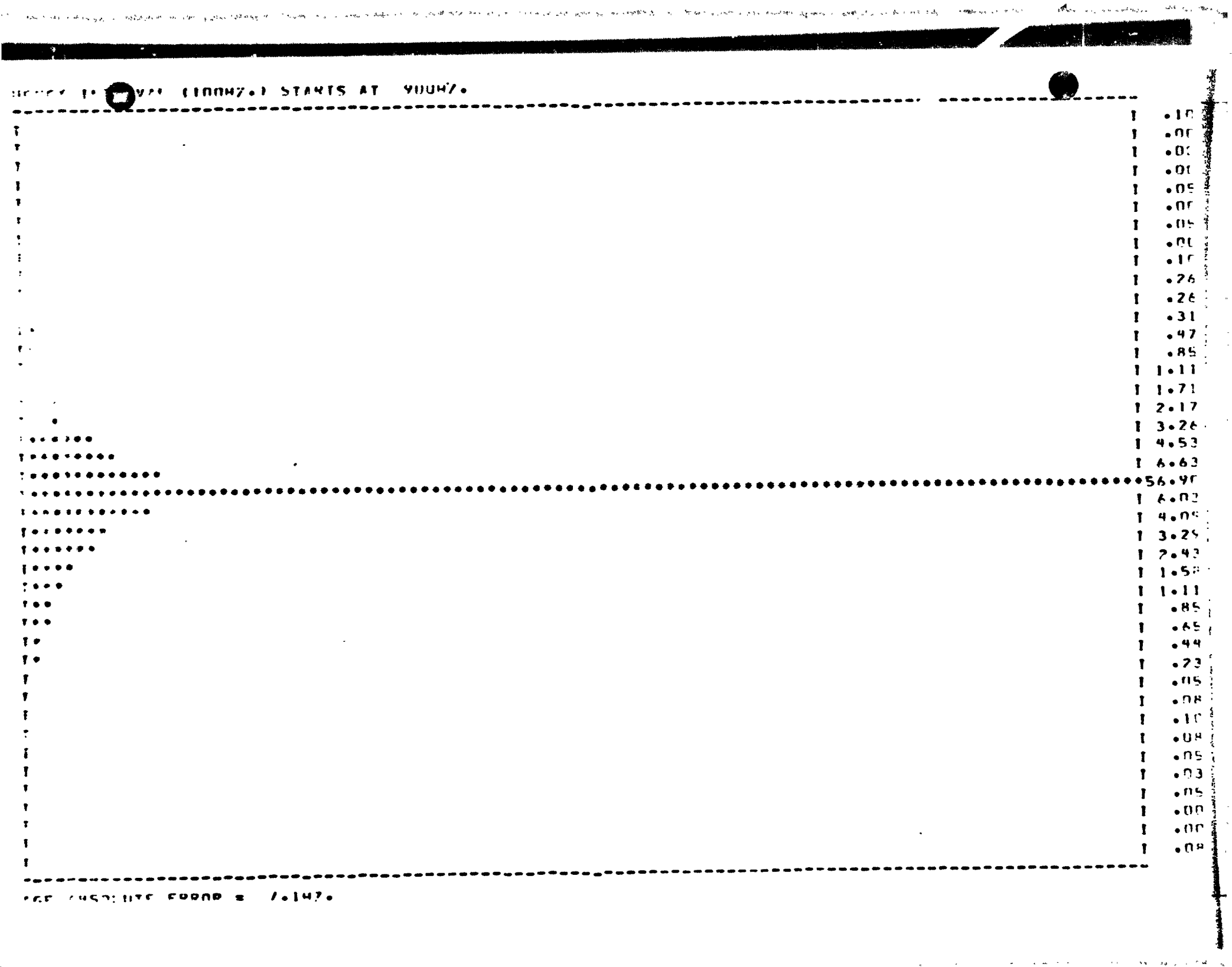

MEAN ABSOLUTE ERROR (Hz.)
0
5
10
15
20
25
VCO FREQ. (KHz)
0
1
2
3
0
2.1
4.4
6.6
8.9
11.2
AMPLITUDE MEASUREMENT ERROR (%)

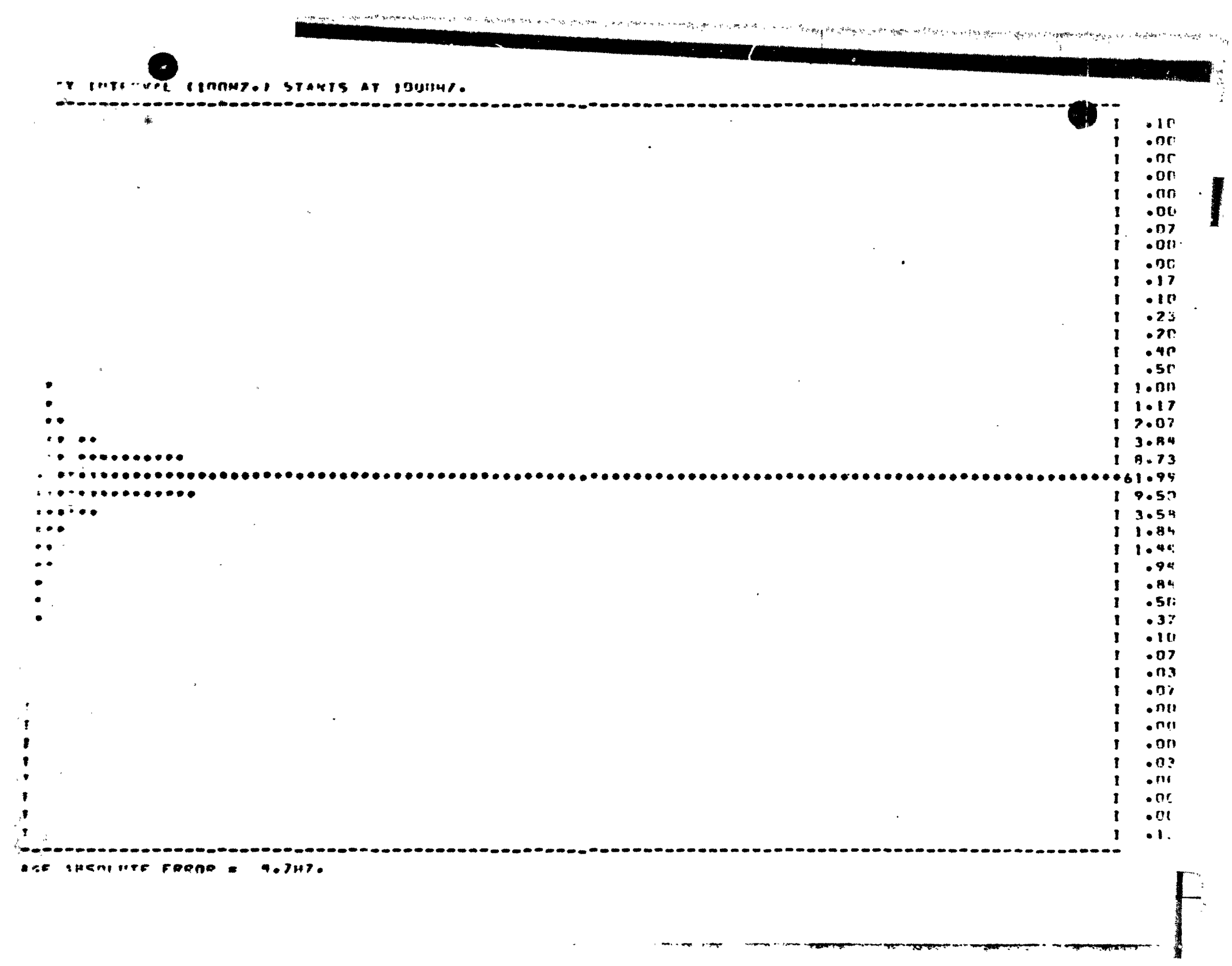

FREQUENCY INTERVAL (1000HZ/.1 STARTS AT 400HZ.
BAR ABSOLUTE ERROR = 15.40%.

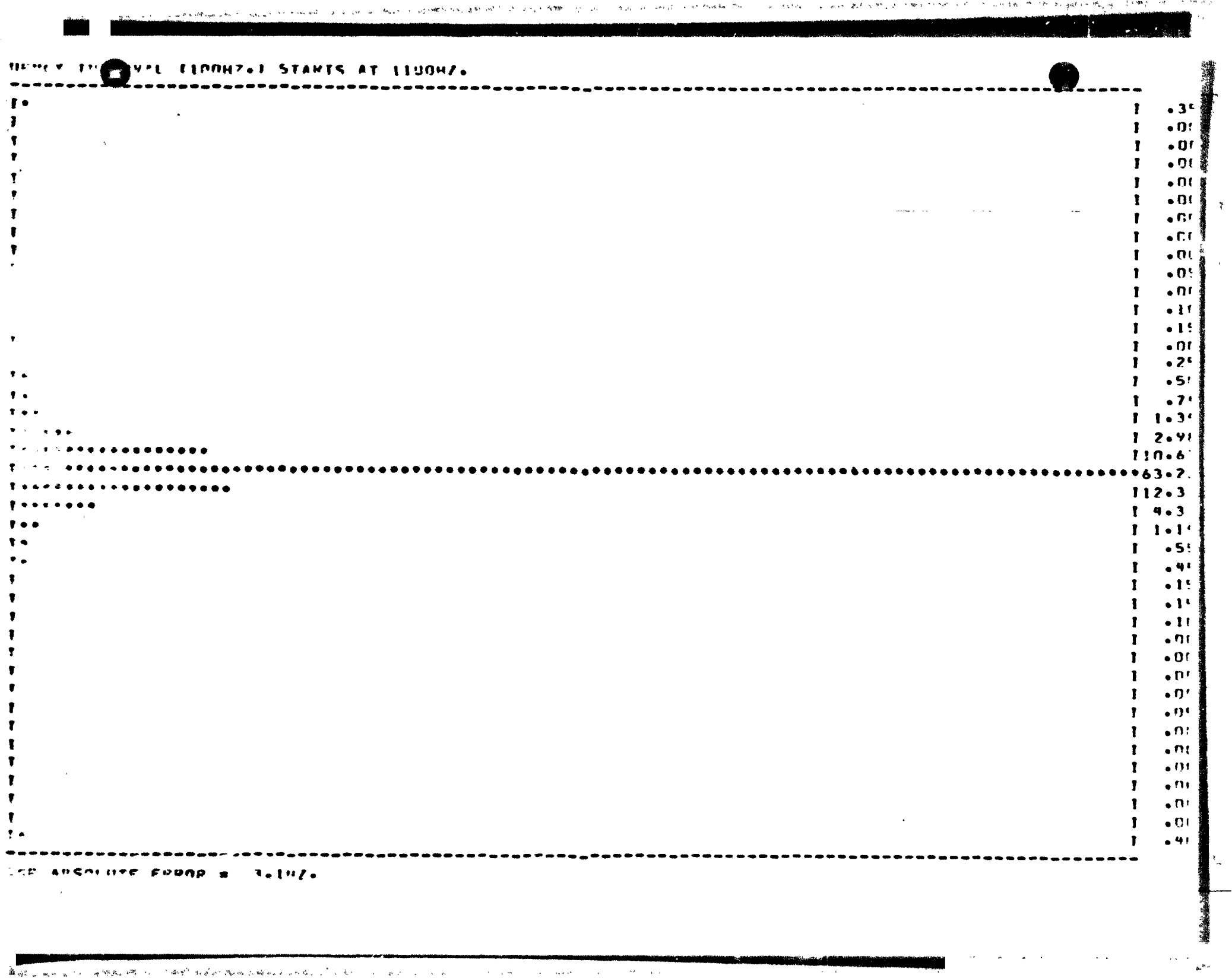


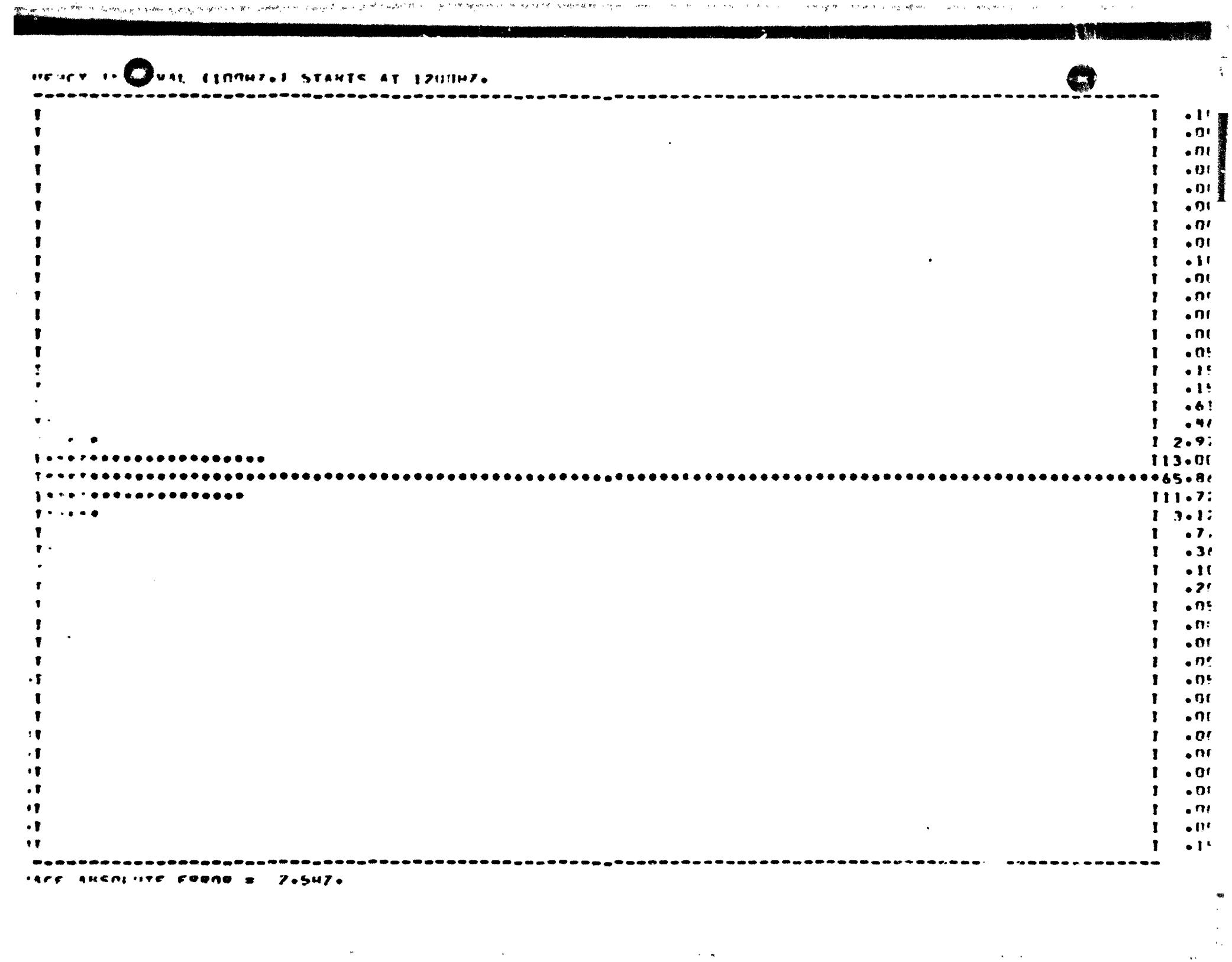


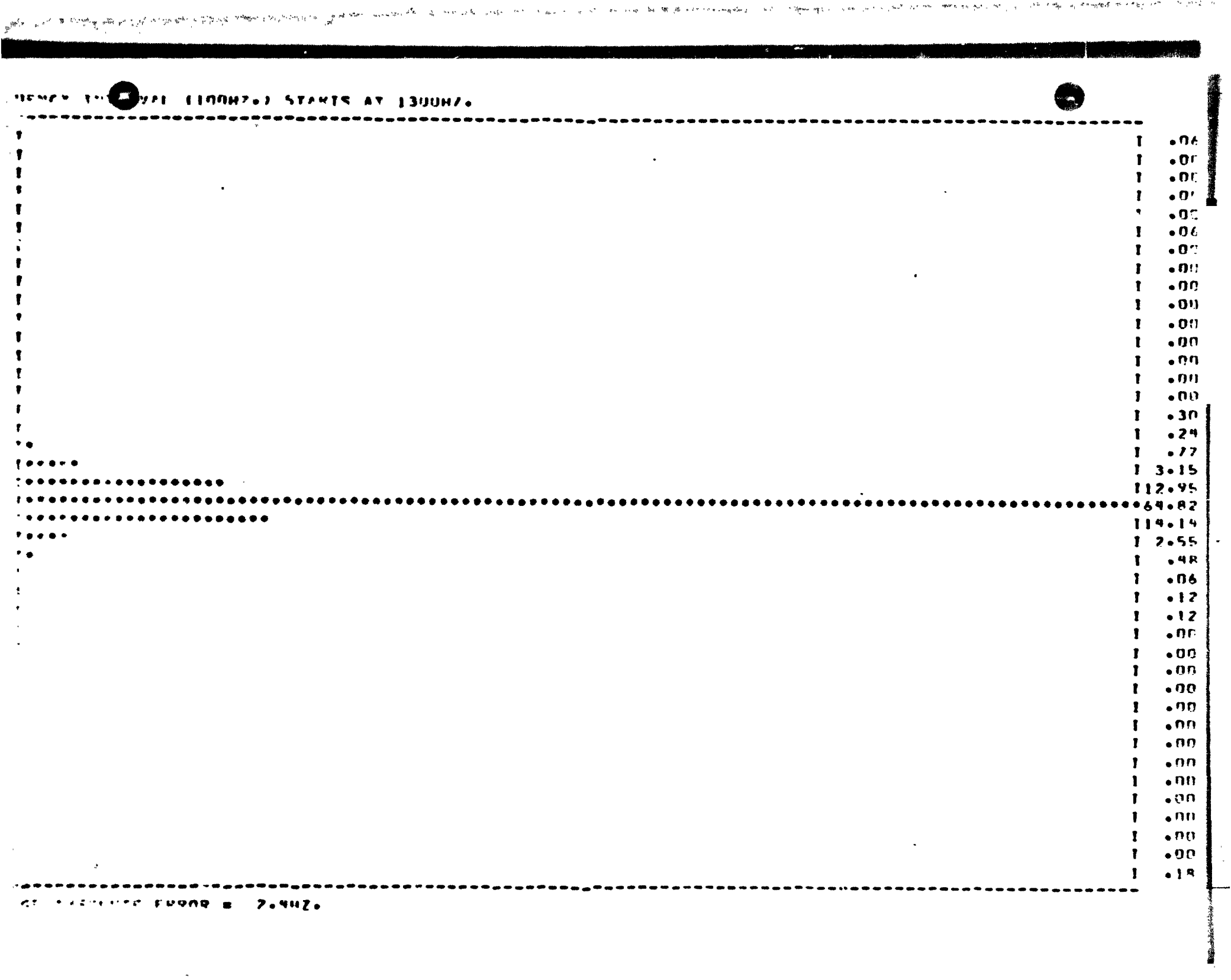

STARTS AT 80947.
.0
.0
.0
.0
.0
.0
.0
.0
.1
.2
.2
.4
.8
1.1
1.4
2.1
2.6
2.8
4.3
4.3
57.8
5.1
4.2
2.7
2.8
1.5
1.3
1.0
.7
.5
.3
.3
.1
.0
.0
.0
.0
.0
.0
.0
/.947.

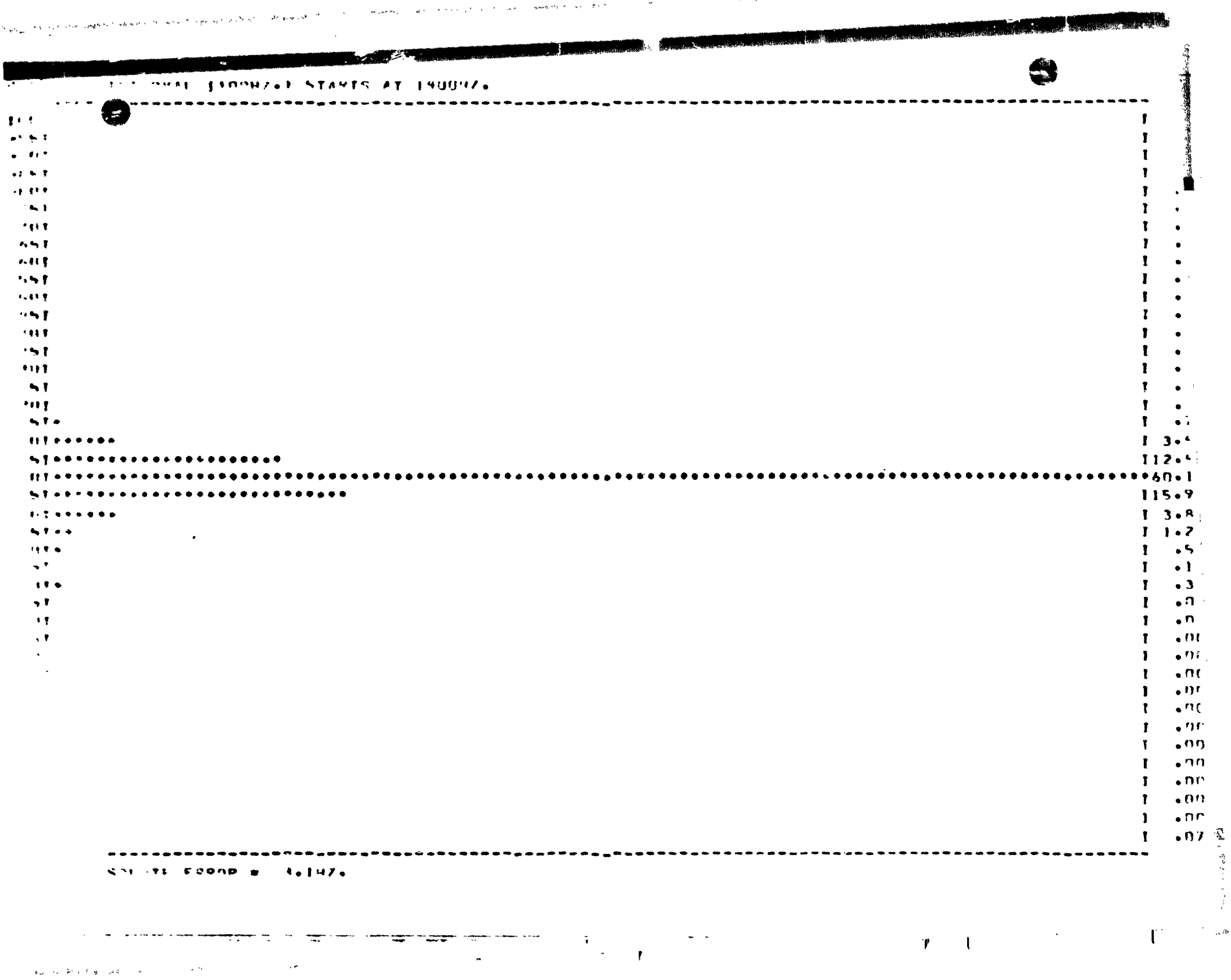

STARTS AT
.10
.00
.03
.01
.09
.00
.09
.01
.10
.26
.28
.31
.47
.85
1.11
1.71
2.17
3.26
4.53
6.63
56.90
6.02
4.09
3.29
2.43
1.58
1.11
.85
.65
.44
.23
.05
.08
.10
.08
.05
.03
.05
.00
.00
.08

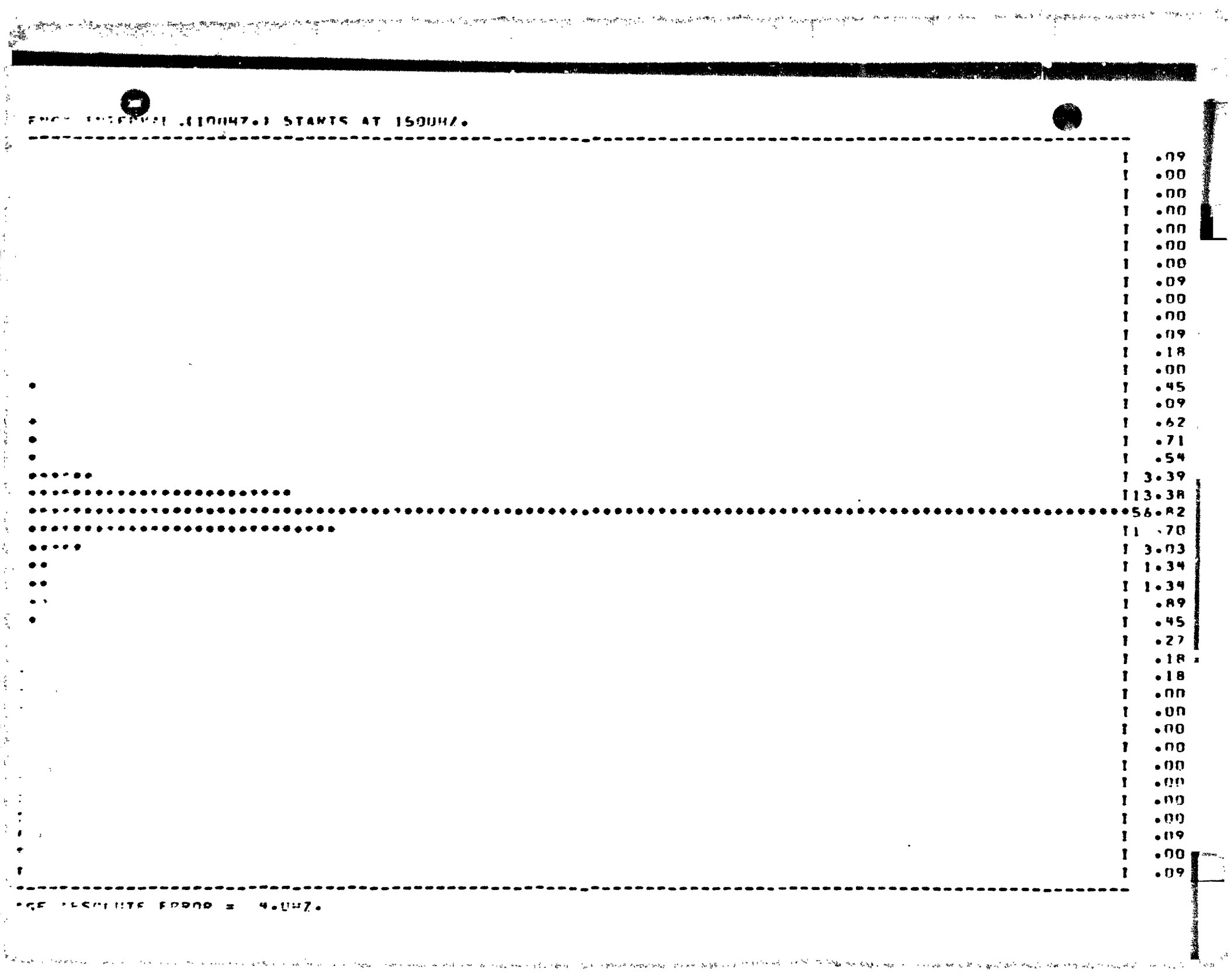

FY INTERVAL (100HZ.) STARTS AT 100HZ.
.10
.00
.00
.00
.00
.00
.07
.00
.00
.17
.10
.23
.20
.40
.50
1.00
1.17
2.07
3.84
8.73
61.99
9.50
3.58
1.84
1.44
.94
.84
.56
.37
.10
.07
.03
.07
.00
.00
.00
.03
.00
.00
.01
1.
AGE ABSOLUTE ERROR = 4.7HZ.

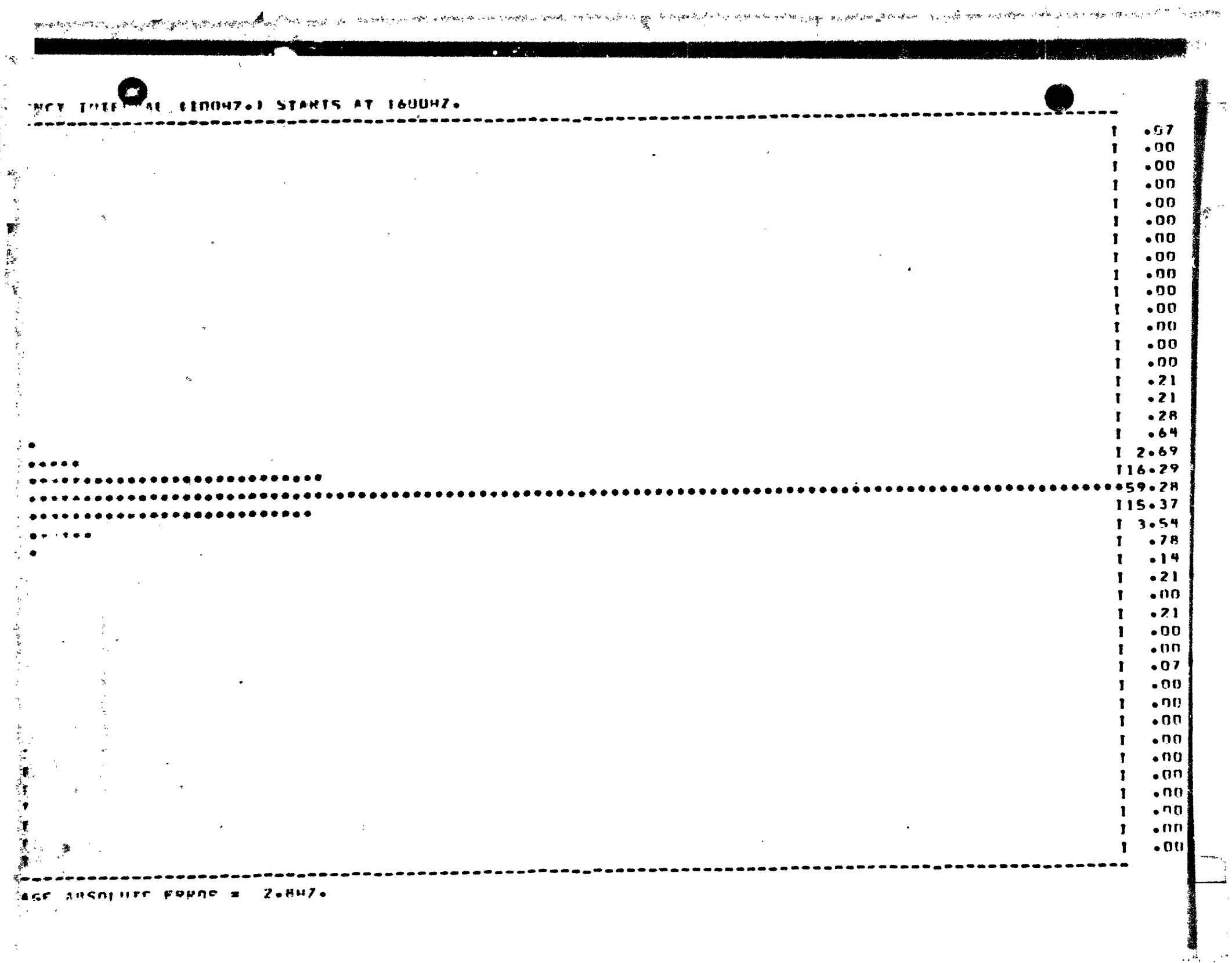

[illegible] LEVEL EIGHTHZ.I STARTS AT 11UUHZ.
.3
.0
.0
.0
.0
.0
.0
.0
.0
.0
.0
.0
.1
.1
.0
.2
.5
.7
1.3
2.9
10.6
63.2
12.3
4.3
1.1
.5
.4
.1
.1
.1
.0
.0
.0
.0
.0
.0
.0
.0
.0
.0
.4
[illegible] ABSOLUTE ERROR = 3.1HZ.

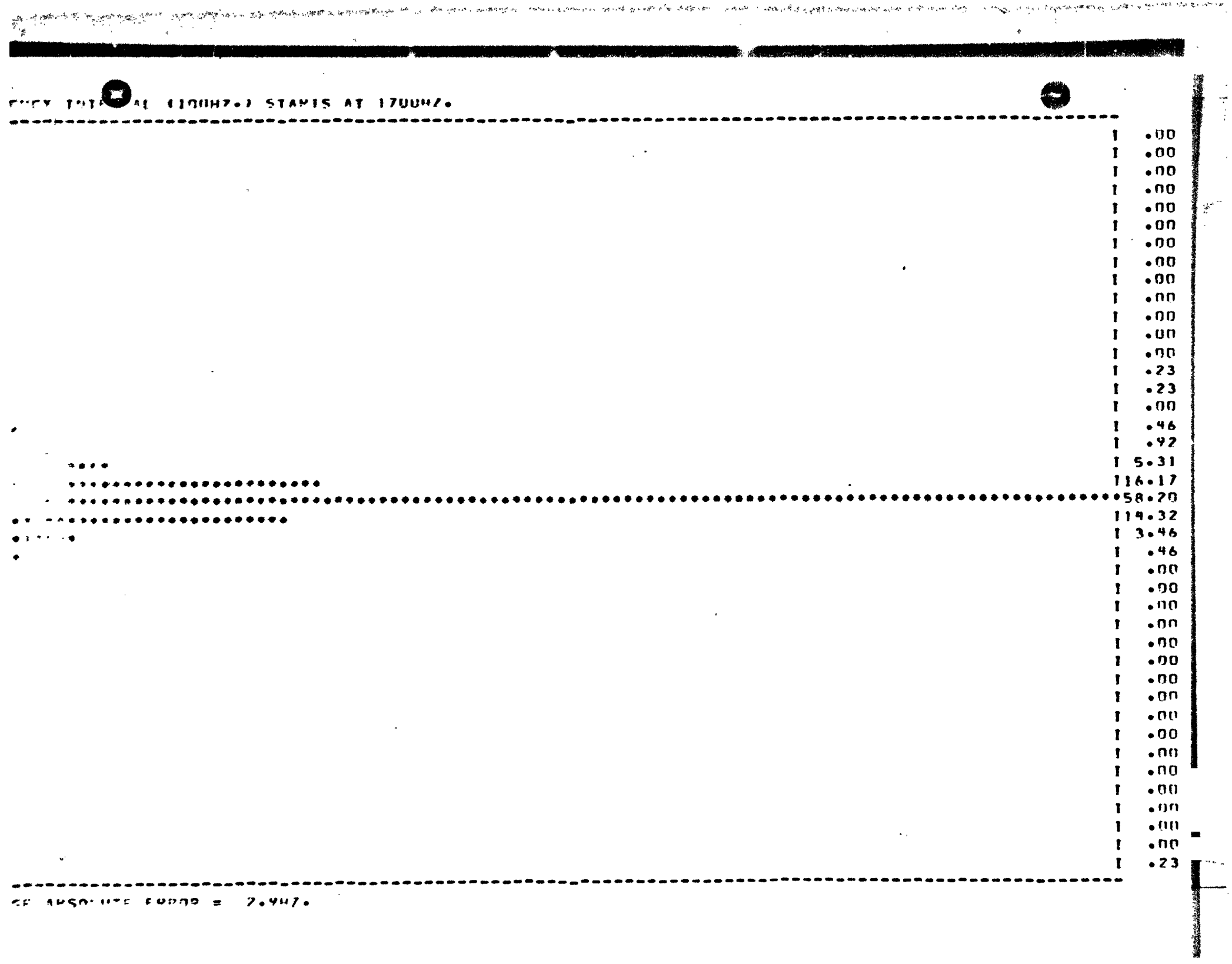


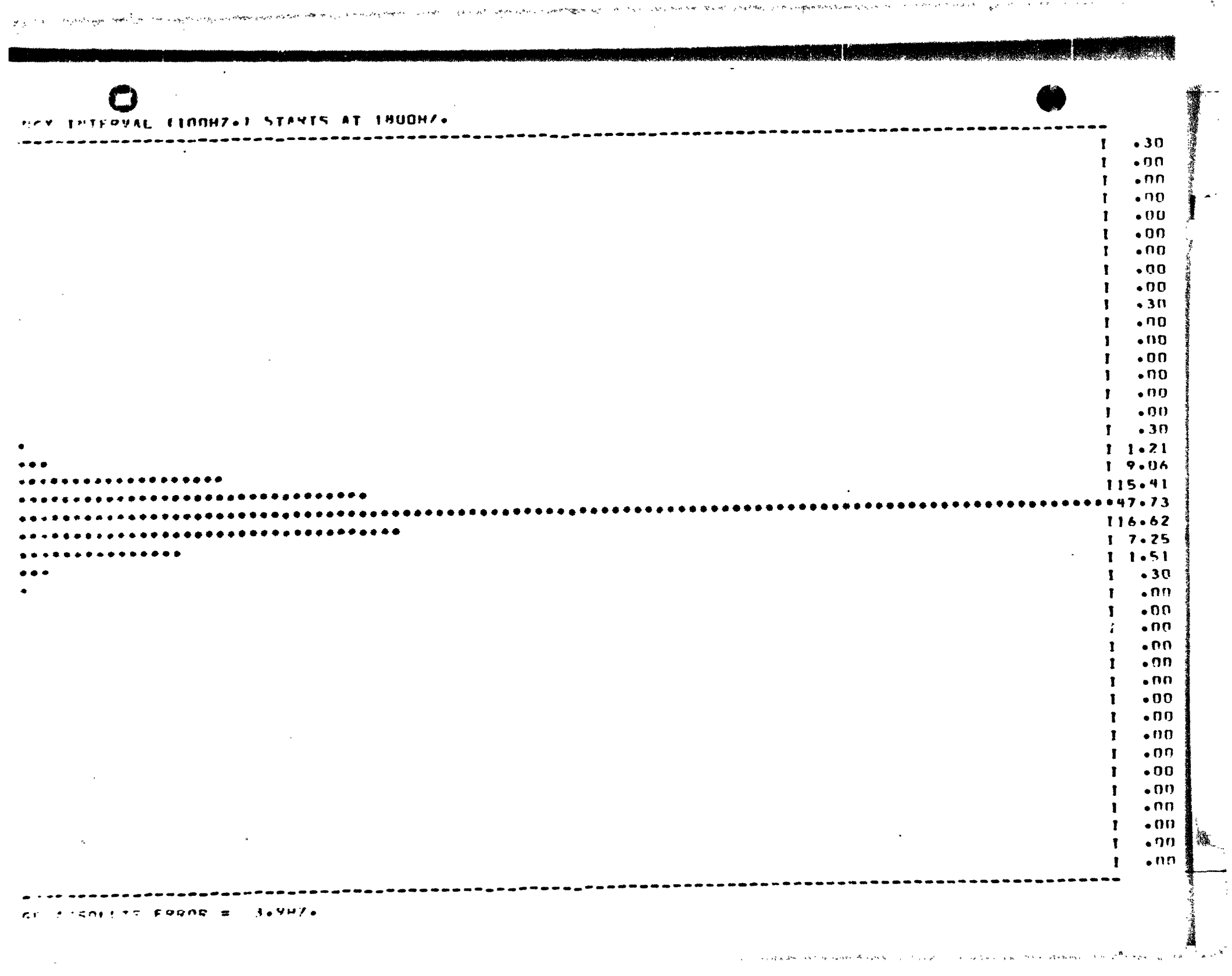

STARTS AT 1300HZ.
.06
.05
.04
.07
.03
.06
.02
.00
.00
.00
.00
.00
.00
.30
.24
.77
3.15
12.95
64.82
19.14
2.55
.48
.06
.12
.12
.00
.00
.00
.00
.00
.00
.00
.00
.00
.00
.00
.00
.18
7.4HZ.

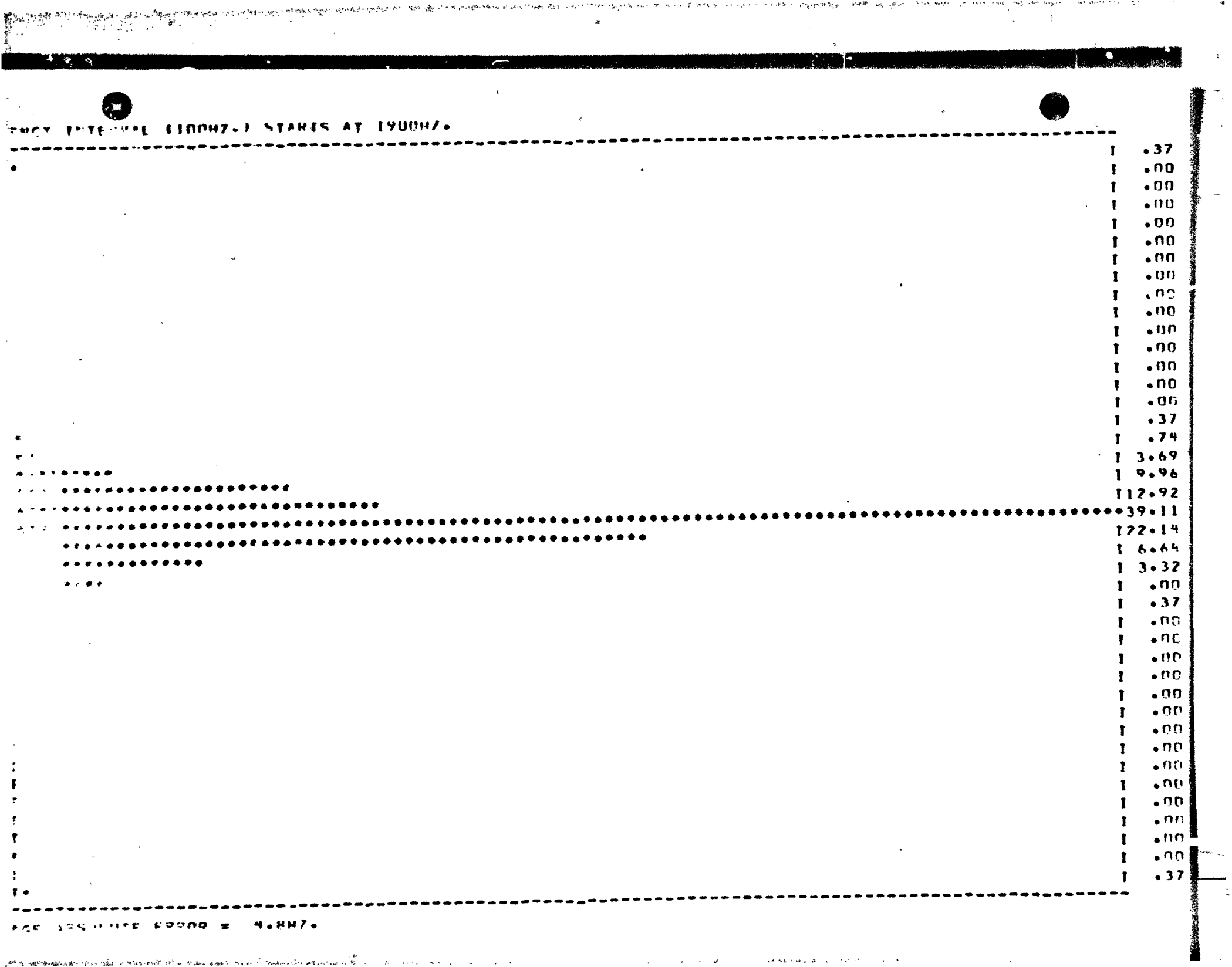

SIGNAL [100HZ.] STARTS AT 1400HZ.
60.1
115.9
SIGNAL POWER = 4.147.

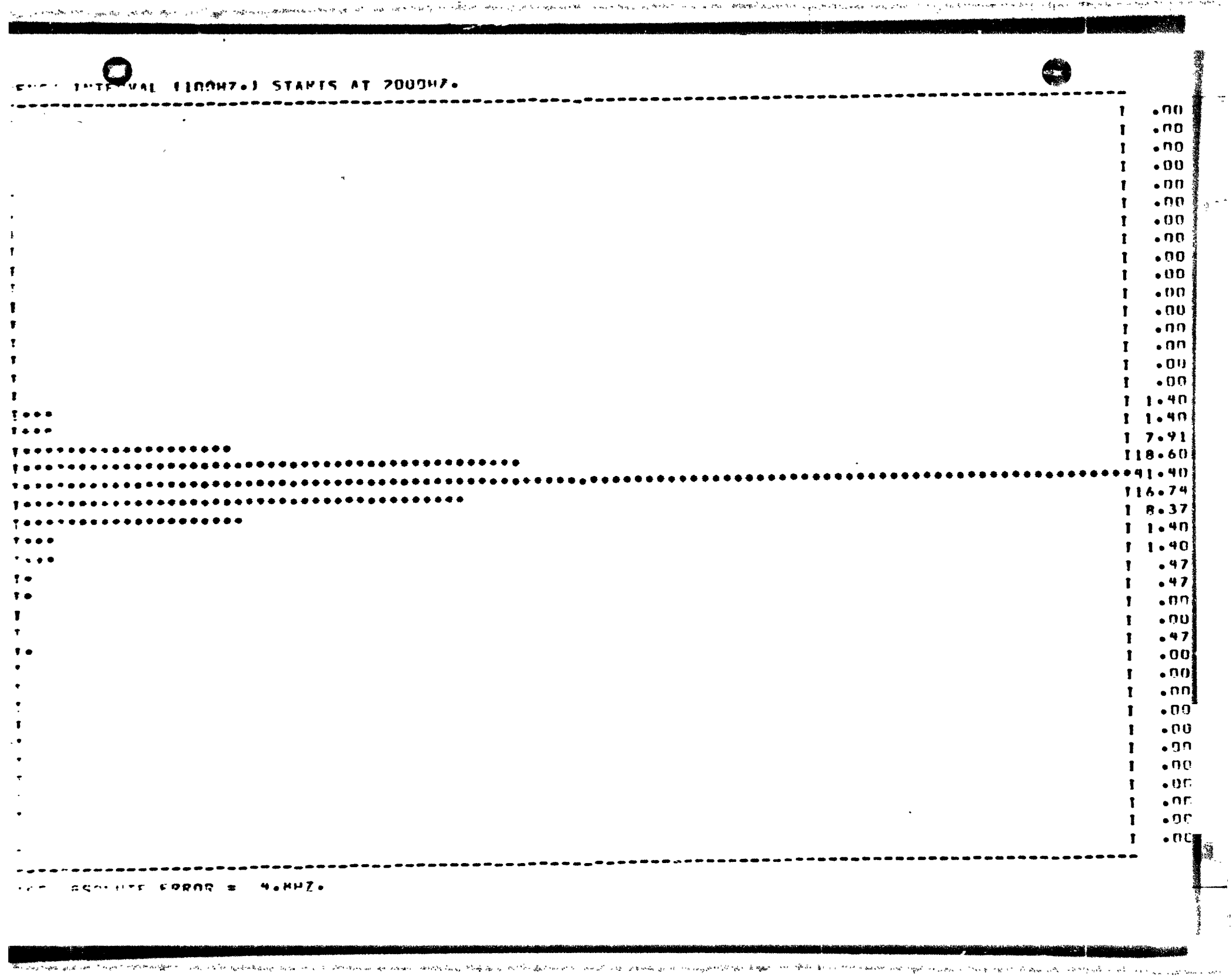

EACH INTERVAL (10047.) STARTS AT 1500HZ.
.09
.00
.00
.00
.00
.00
.00
.09
.00
.00
.09
.18
.00
.45
.09
.62
.71
.54
3.39
13.38
56.82
.70
3.03
1.34
1.34
.89
.45
.27
.18
.18
.00
.00
.00
.00
.00
.00
.00
.09
.00
.09
ABSOLUTE ERROR = 4.0HZ.

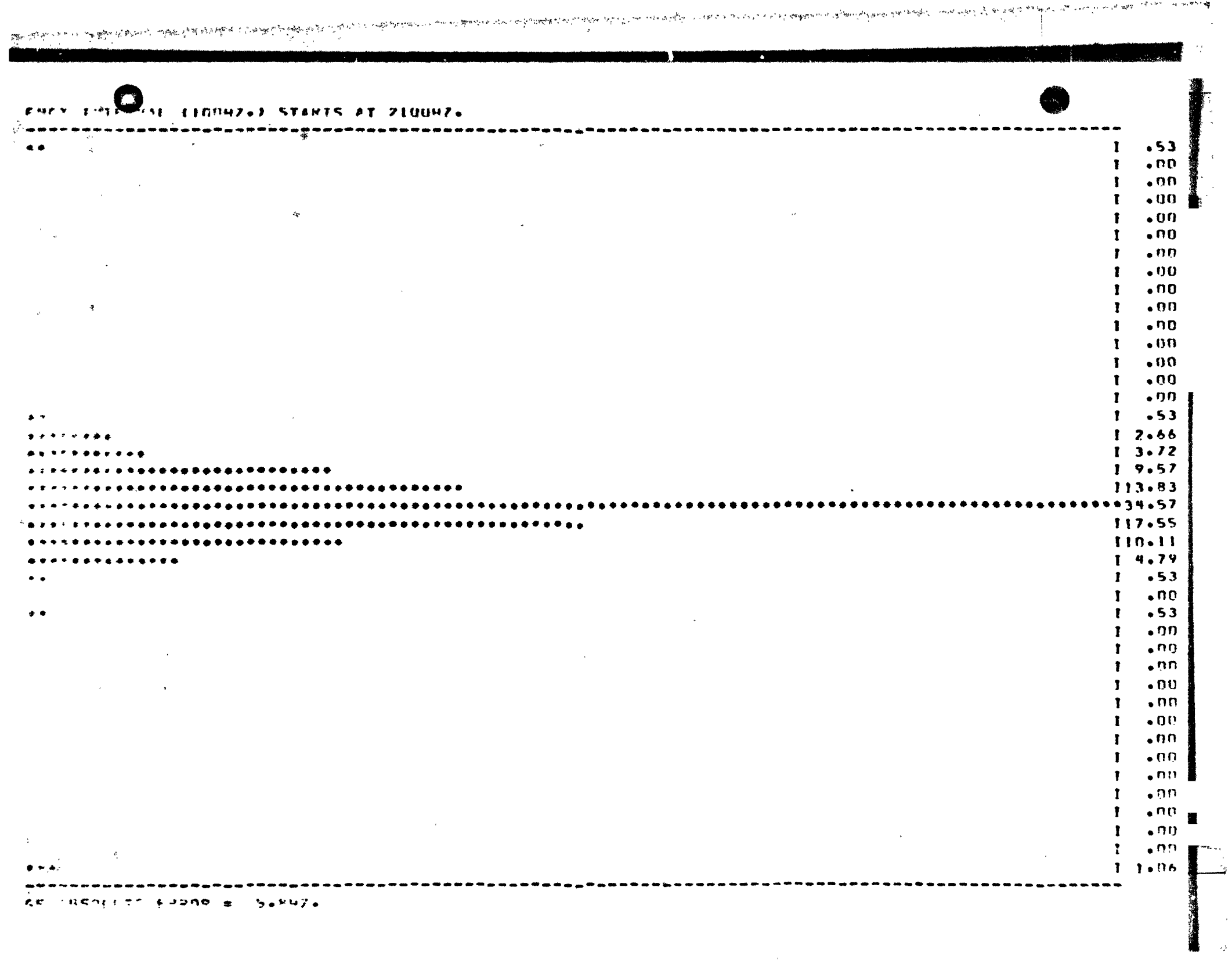

NCY INTERVAL (800HZ.) STARTS AT 1600HZ.
1 .07
1 .00
1 .00
1 .00
1 .00
1 .00
1 .00
1 .00
1 .00
1 .00
1 .00
1 .00
1 .00
1 .21
1 .21
1 .28
1 .64
1 2.69
116.29
59.28
115.37
1 3.54
1 .78
1 .14
1 .21
1 .00
1 .21
1 .00
1 .00
1 .07
1 .00
1 .00
1 .00
1 .00
1 .00
1 .00
1 .00
1 .00
AGE AMPLITUDE FOUND = 2.8HZ.

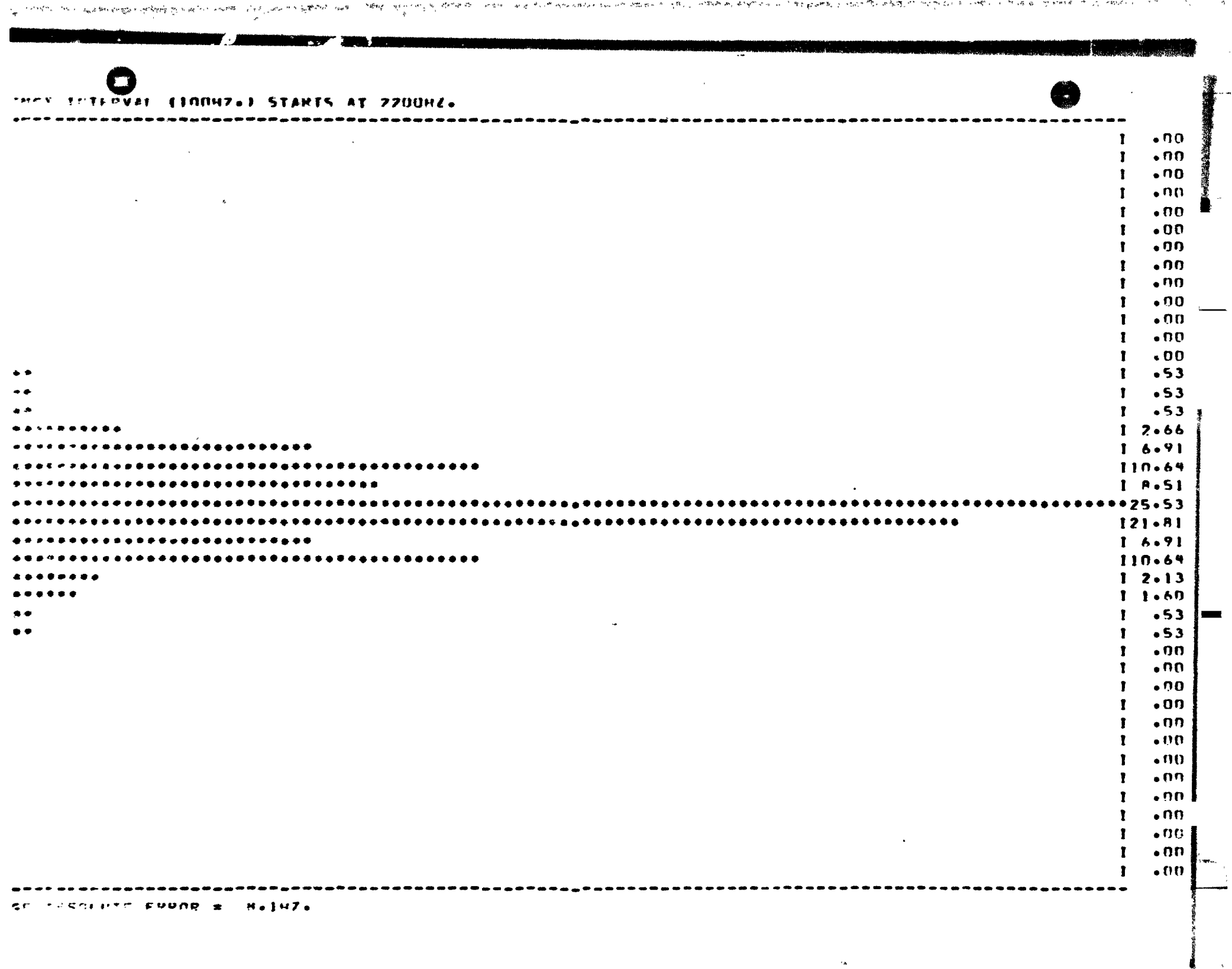

ENERGY INTEGRAL (100HZ-) STARTS AT 1700HZ.
.00
.00
.00
.00
.00
.00
.00
.00
.00
.00
.00
.00
.00
.23
.23
.00
.46
.92
5.31
16.17
58.20
14.32
3.46
.46
.00
.00
.00
.00
.00
.00
.00
.00
.00
.00
.00
.00
.00
.00
.23
OF ABSOLUTE ERROR = 2.9HZ.

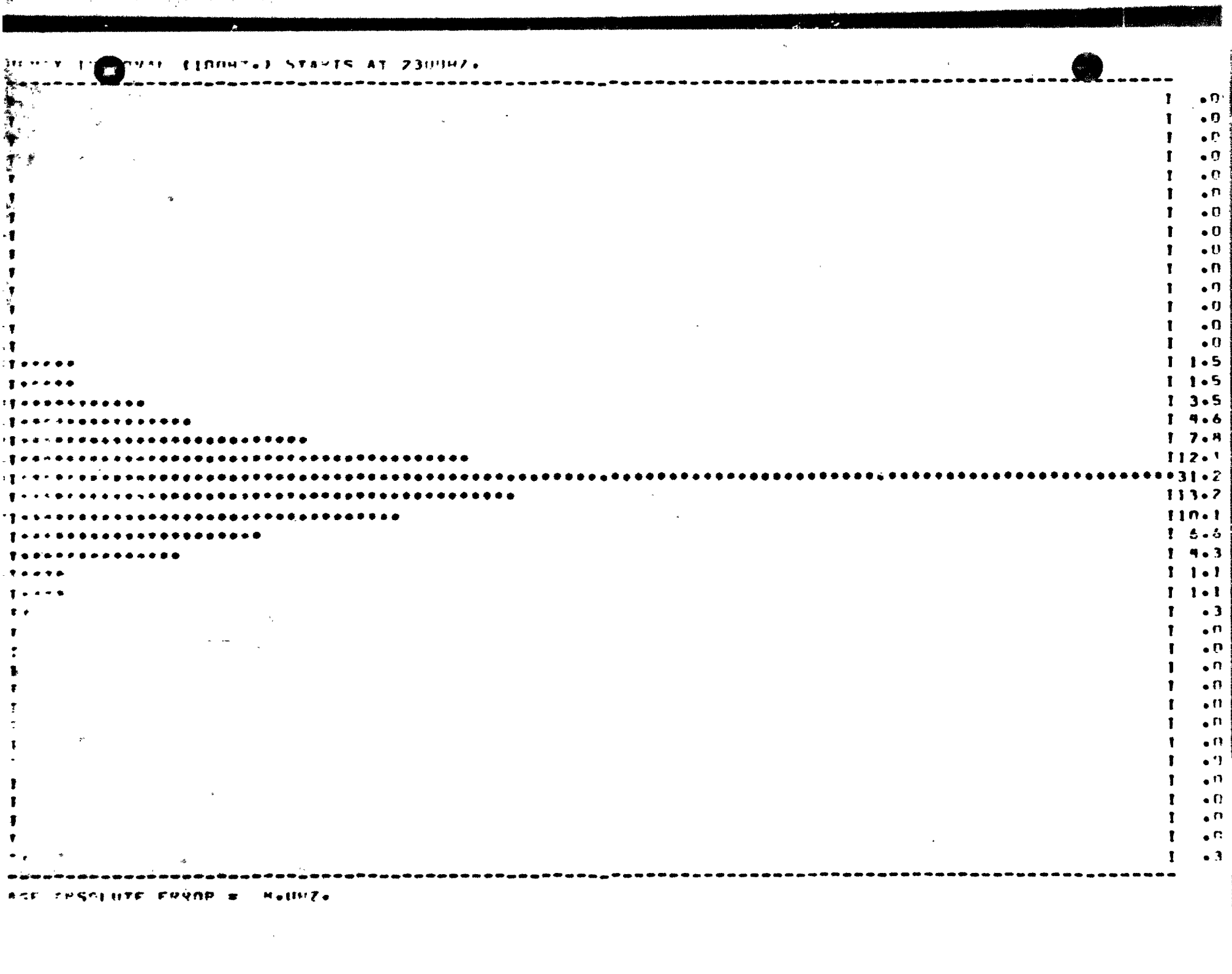

KEY INTERVAL (1000H7.) STARTS AT 1800H/.
I .30
I .00
I .00
I .00
I .00
I .00
I .00
I .00
I .00
I .30
I .00
I .00
I .00
I .00
I .00
I .00
I .30
I 1.21
I 9.06
I15.41
I47.73
I16.62
I 7.25
I 1.51
I .30
I .00
I .00
I .00
I .00
I .00
I .00
I .00
I .00

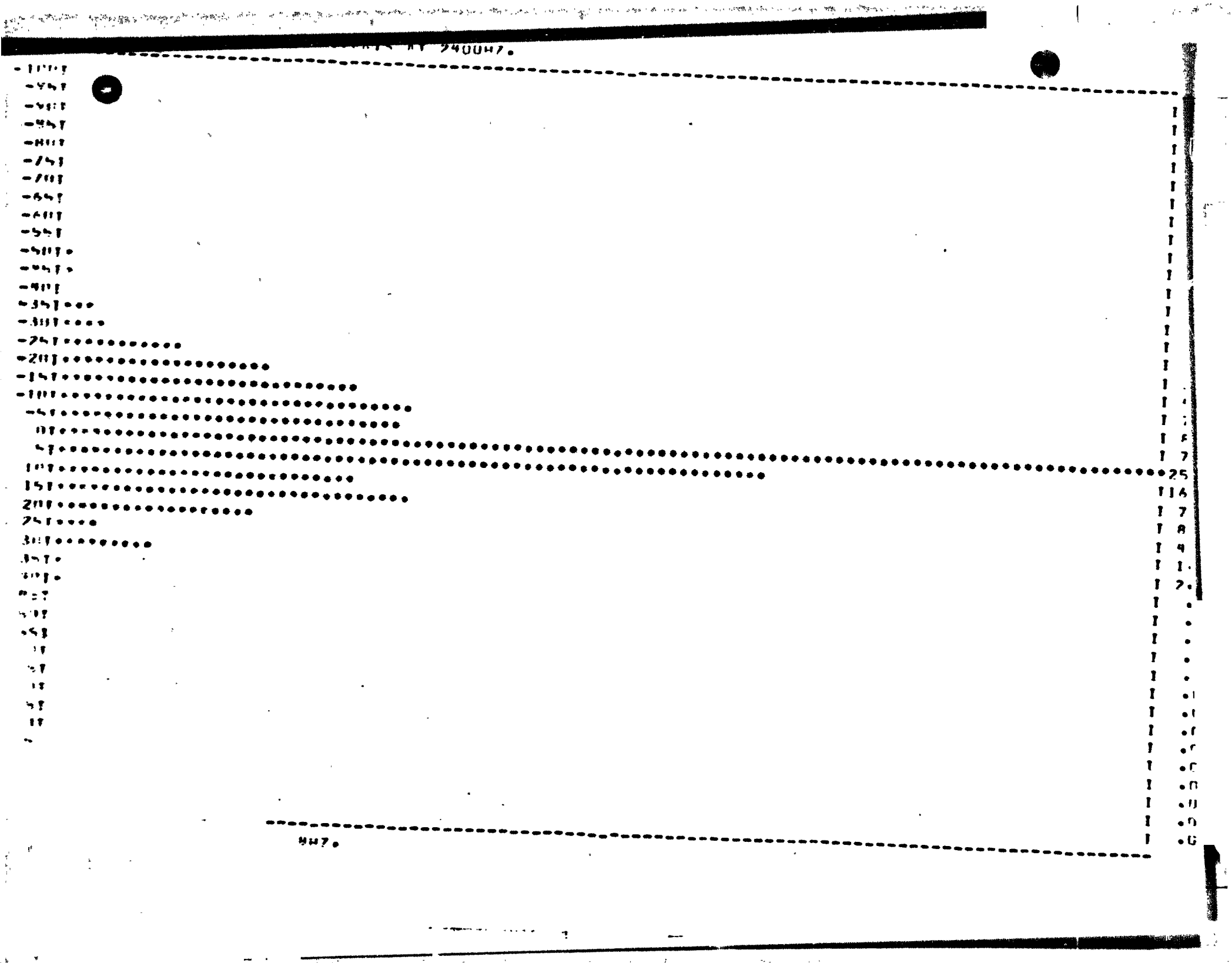

ENCY INTERVAL (100HZ.) STARTS AT 1900HZ.
1 .37
1 .00
1 .00
1 .00
1 .00
1 .00
1 .00
1 .00
1 .00
1 .00
1 .00
1 .00
1 .00
1 .37
1 .74
1 3.69
1 9.96
112.92
139.11
122.14
1 6.64
1 3.32
1 .00
1 .37
1 .00
1 .00
1 .00
1 .00
1 .00
1 .00
1 .00
1 .00
1 .00
1 .00
1 .00
1 .37

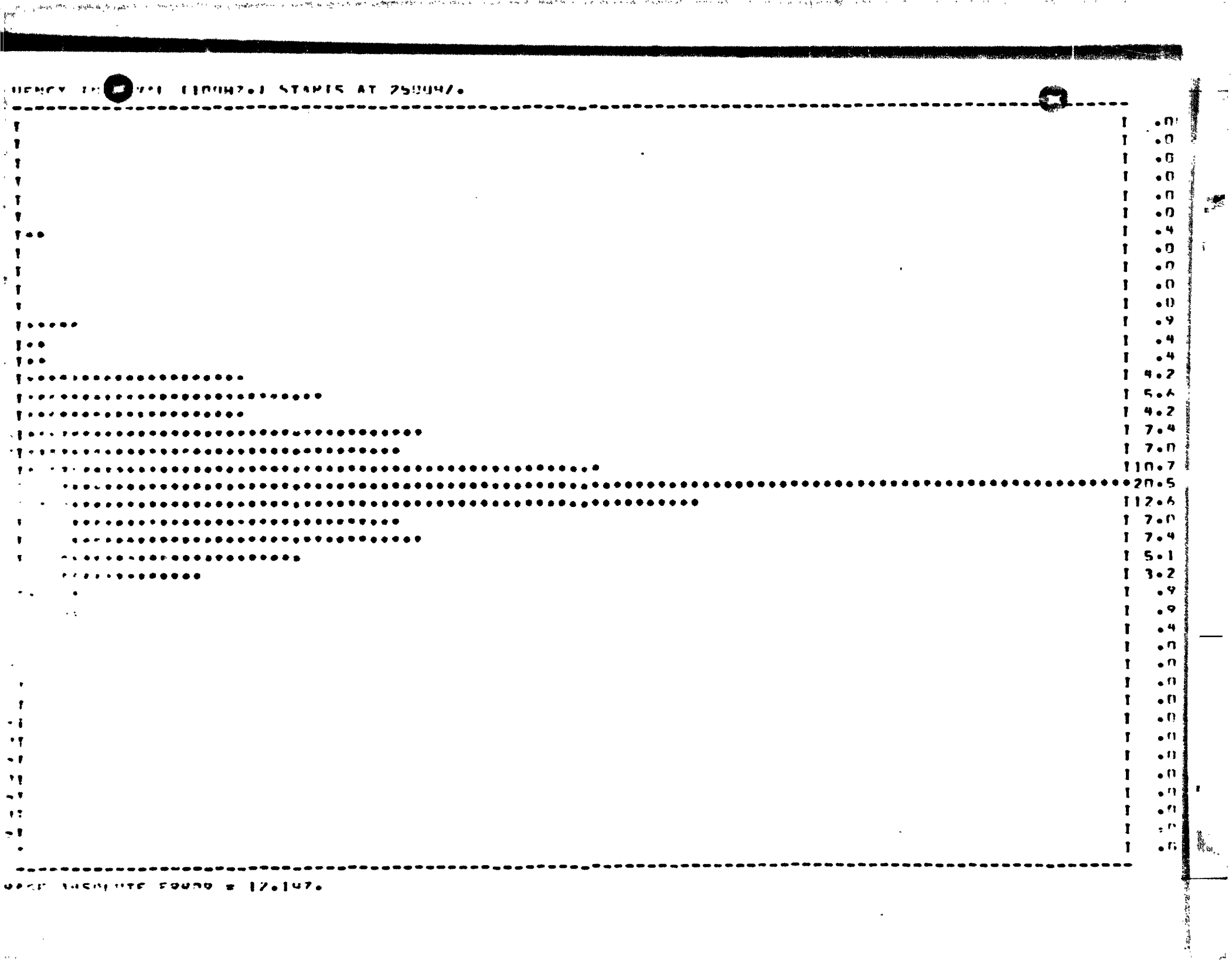

INTERVAL (100HZ.) STARTS AT 2000HZ.
1 .00
1 .00
1 .00
1 .00
1 .00
1 .00
1 .00
1 .00
1 .00
1 .00
1 .00
1 .00
1 .00
1 .00
1 1.40
1 1.40
1 7.91
118.60
91.40
116.74
1 8.37
1 1.40
1 1.40
1 .47
1 .47
1 .00
1 .00
1 .47
1 .00
1 .00
1 .00
1 .00
1 .00
1 .00
1 .00
1 .00
1 .00
1 .00
RESOLUTE ERROR = 4.KHZ.

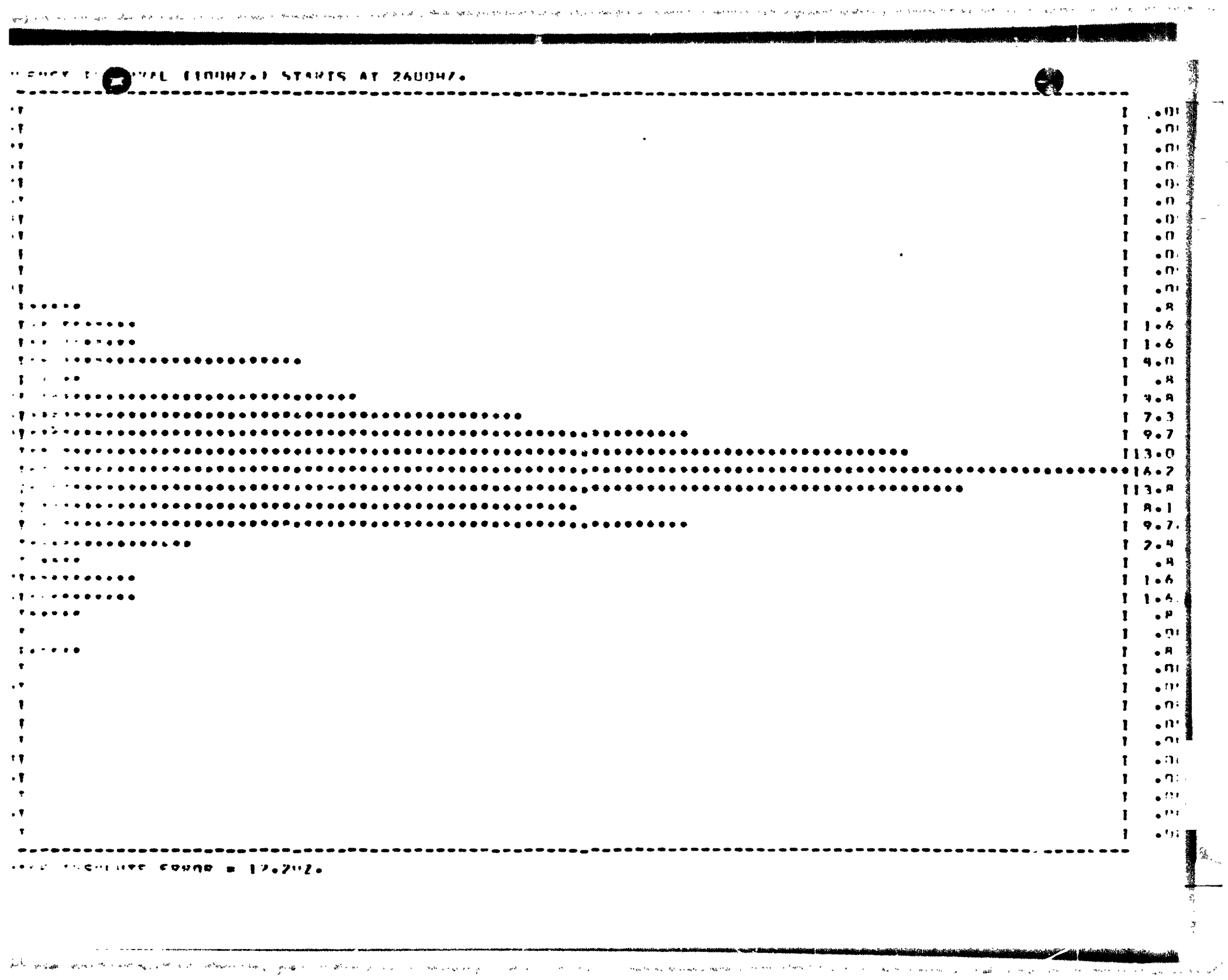

ENCY INTERVAL (100047.) STARTS AT 210047.
.53
.00
.00
.00
.00
.00
.00
.00
.00
.00
.00
.00
.53
2.66
3.72
9.57
13.83
34.57
17.55
10.11
4.79
.53
.00
.53
.00
.00
.00
.00
.00
.00
.00
.00
.00
.00
.00
.00
1.06

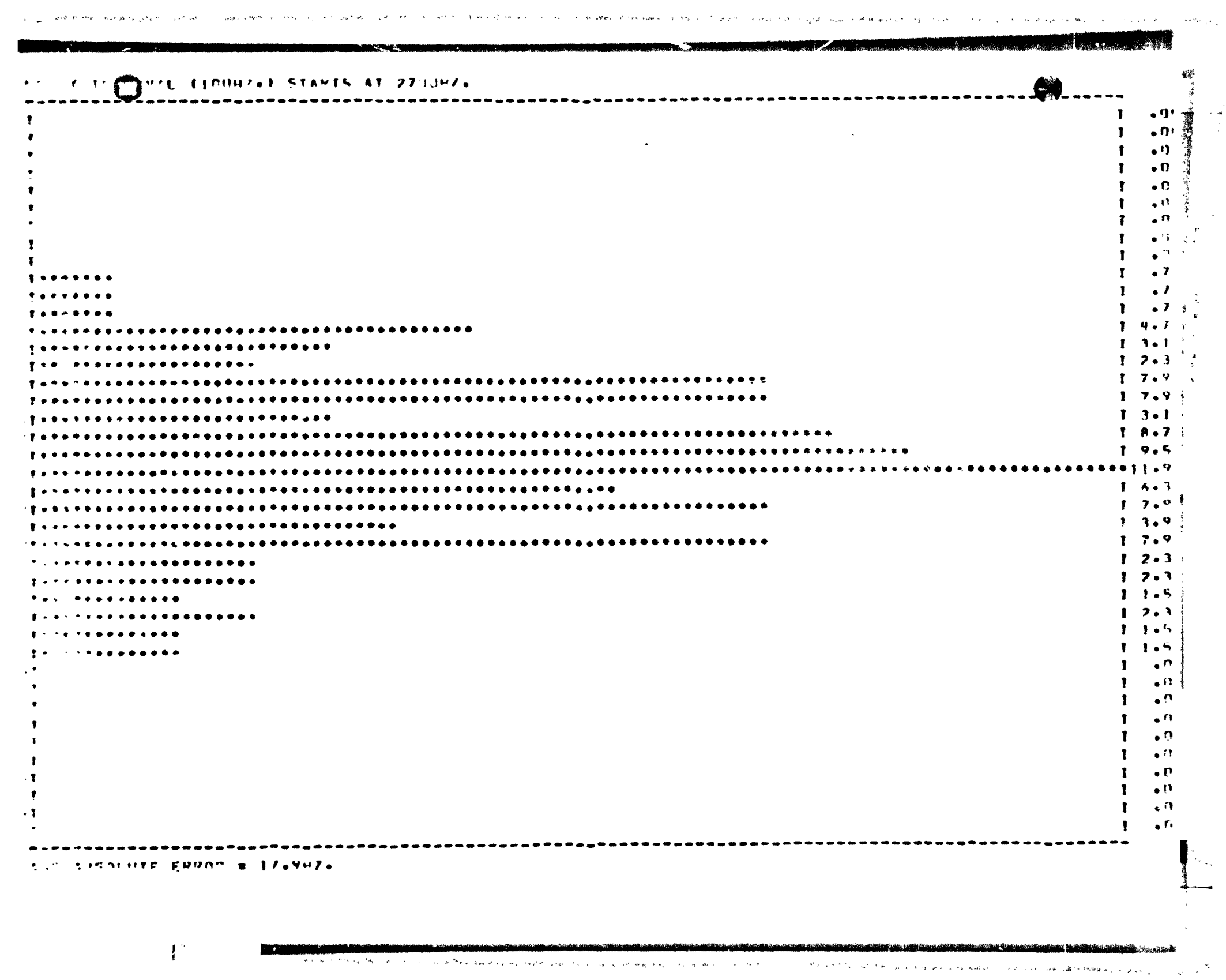

INCY INTERVAL (100HZ.) STARTS AT 2200HZ.
1 .00
1 .00
1 .00
1 .00
1 .00
1 .00
1 .00
1 .00
1 .00
1 .00
1 .00
1 .00
1 .53
1 .53
1 .53
1 2.66
1 6.91
110.64
1 8.51
25.53
121.81
1 6.91
110.64
1 2.13
1 1.60
1 .53
1 .53
1 .00
1 .00
1 .00
1 .00
1 .00
1 .00
1 .00
1 .00
1 .00
1 .00
1 .00
OF ABSOLUTE ERROR = 8.147.

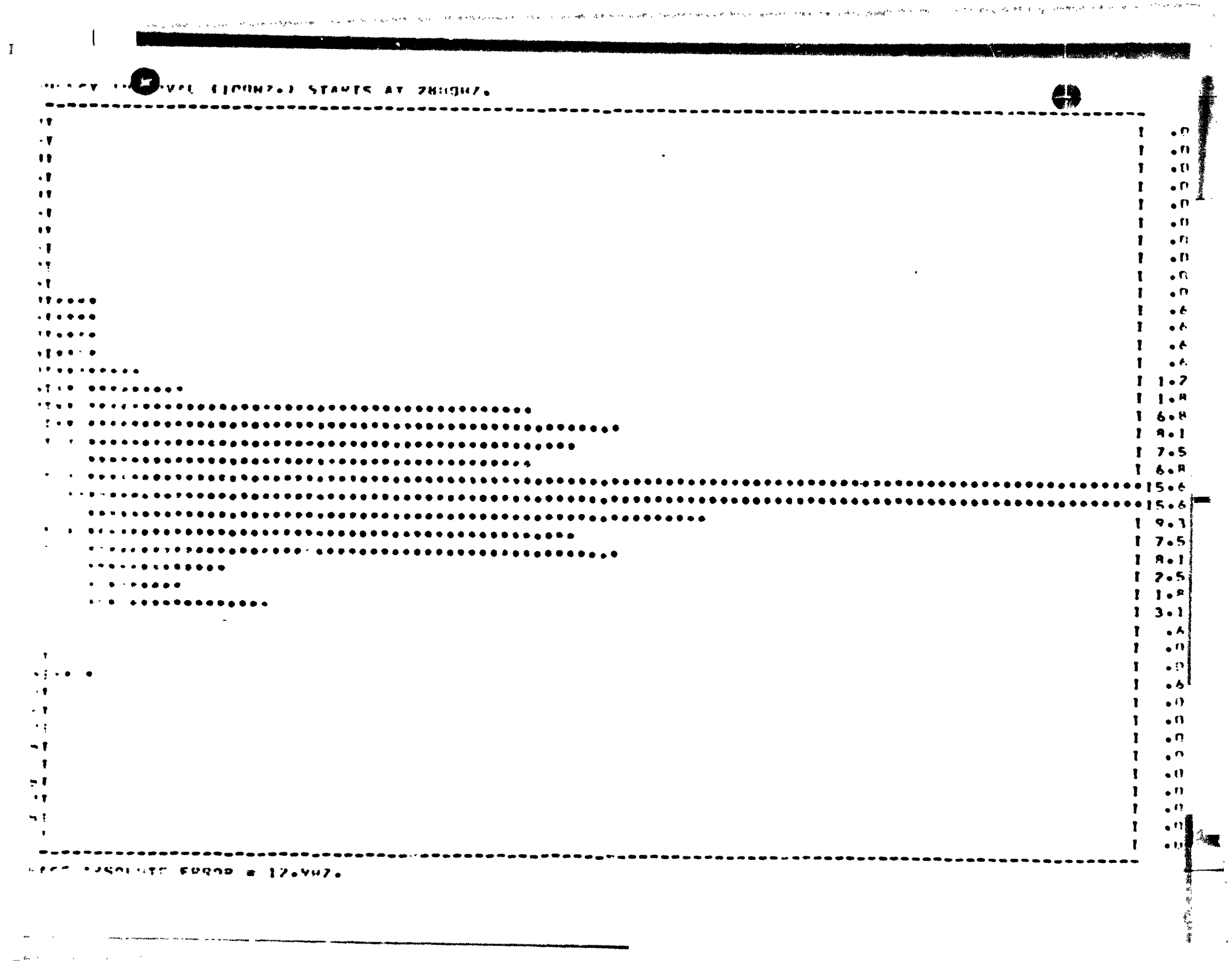

STARTS AT 23.0HZ.
.0
.0
.0
.0
.0
.0
.0
.0
.0
.0
.0
.0
.0
1.5
1.5
3.5
4.6
7.8
12.1
31.2
13.7
10.1
6.6
4.3
1.1
1.1
.3
.0
.0
.0
.0
.0
.0
.0
.0
.0
.0
.0
.3
ABSOLUTE ERROR = .0HZ.

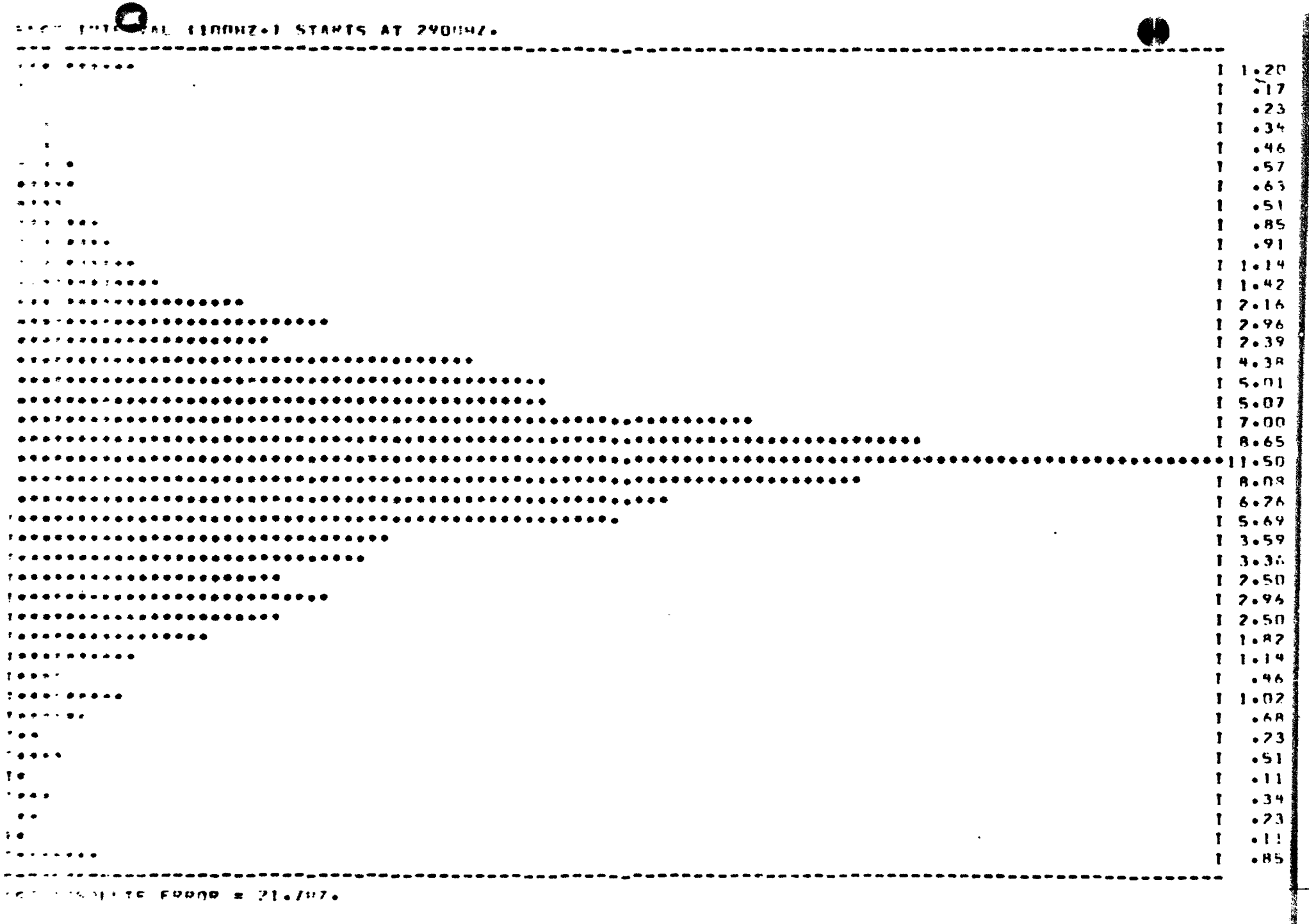

2400HZ.
9HZ.






1 .0
1 .0
1 .0
1 .0
1 .0
1 .0
1 .0
1 .7
1 .7
1 .7
1 4.7
1 3.1
1 2.3
1 7.9
1 7.9
1 3.1
1 8.7
1 9.5
1 11.9
1 6.3
1 7.9
1 3.9
1 7.9
1 2.3
1 2.3
1 1.5
1 2.3
1 1.5
1 1.5
1 .0
1 .0
1 .0
1 .0
1 .0
1 .0
1 .0
1 .0
1 .0





APPENDIX F

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION
MANNED SPACECRAFT CENTER
HOUSTON, TEXAS 77058

REPLY TO
ATTN OF: TN2

January 31, 1973

MEMORANDUM

TO: Distribution

FROM: J. D. Redman

SUBJECT: SEP-False Reset Indication in Data from EVA-II

In his memo of January 18, 1973, "SEP-Limitation in Apollo 17 EVA II data tape," Larry Bannister pointed out that the reset pulse that occurred at the range 5.0 km was a false reset pulse that realigned the receiver timing relative to the transmitter. This reset pulse has been looked at more carefully on oscillogram strip charts and on a storage oscilloscope using the SEP receiver timing and the acquisition system to determine exactly where it occurred in the receiver timing chain.

Figure #1 illustrates that the reset pulse occurred in frame 20 when the transmitter was transmitting at 8 MHz on the NS antenna and 32 msec ± 2 msec from the start of that frame. The receiver was in Mode 1 during this 6.48 sec record with the Y receiving antenna connected. From this point to Station #2 the receiver was realigned relative to the transmitter.

The realignment of the receiver and transmitter timing is shown in Figure #2. This assumes that the receiver and transmitter timing had not drifted an appreciable amount since the last true reset pulse. There is an additional 9.5 msec offset that is not shown in the figure for the sake of convenience in the illustration.

It is apparent from this diagram that some useful data, as indicated by the shaded areas, could be recovered at 32 MHz from the broadside antenna. This may be of dubious usefulness since the signal levels at this range are quite low (<-120 dbm). During the remainder of the 6.48 sec period, where the transmitter and receiver frequency do not correspond, some data is available at all the SEP frequencies on the Rover noise levels and/or other background noise sources. In using this data, consideration should be given to the level of the harmonic and non-harmonic frequencies generated by the SEP frequency that is being transmitted and as well the characteristics of the bandpass filter in the receiver should be investigated.

A first glance at these problems suggest that the harmonically related signals are at least 20 db below their fundamental and all non-harmonically related signals are at least 50 db below the fundamental frequency. The receiver filters give a rejection of 40 db for the other SEP frequencies, it appears that these other sources cannot have high enough power levels to influence the ambient noise measurements.

J. D. Redman

2 Enclosures

Distribution:
R. D. Watts
D. W. Strangway
J. Groener
L. H. Bannister
G. Simmons
D. Cubley

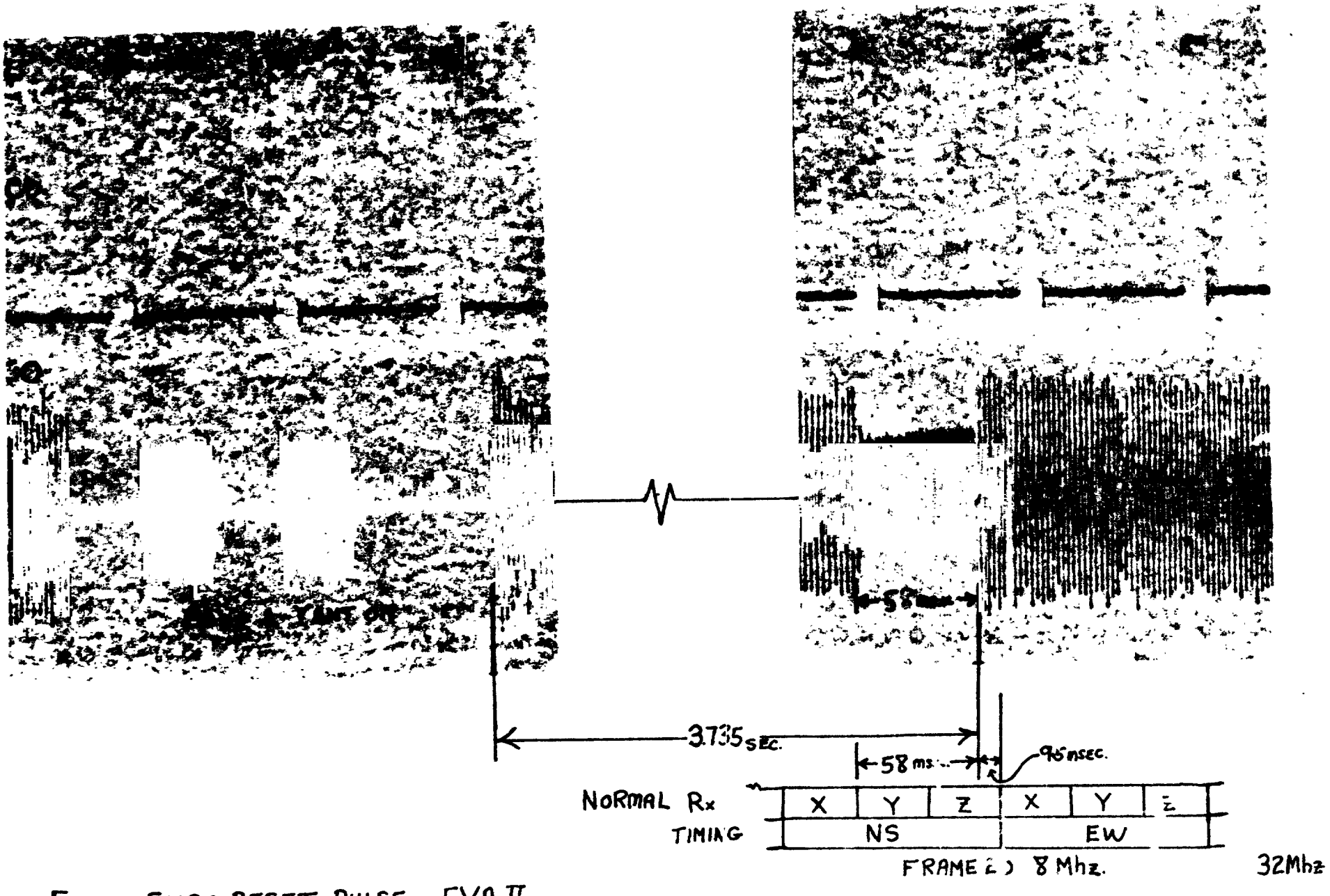


FIG.#1 FALSE RESET PULSE EVA-II

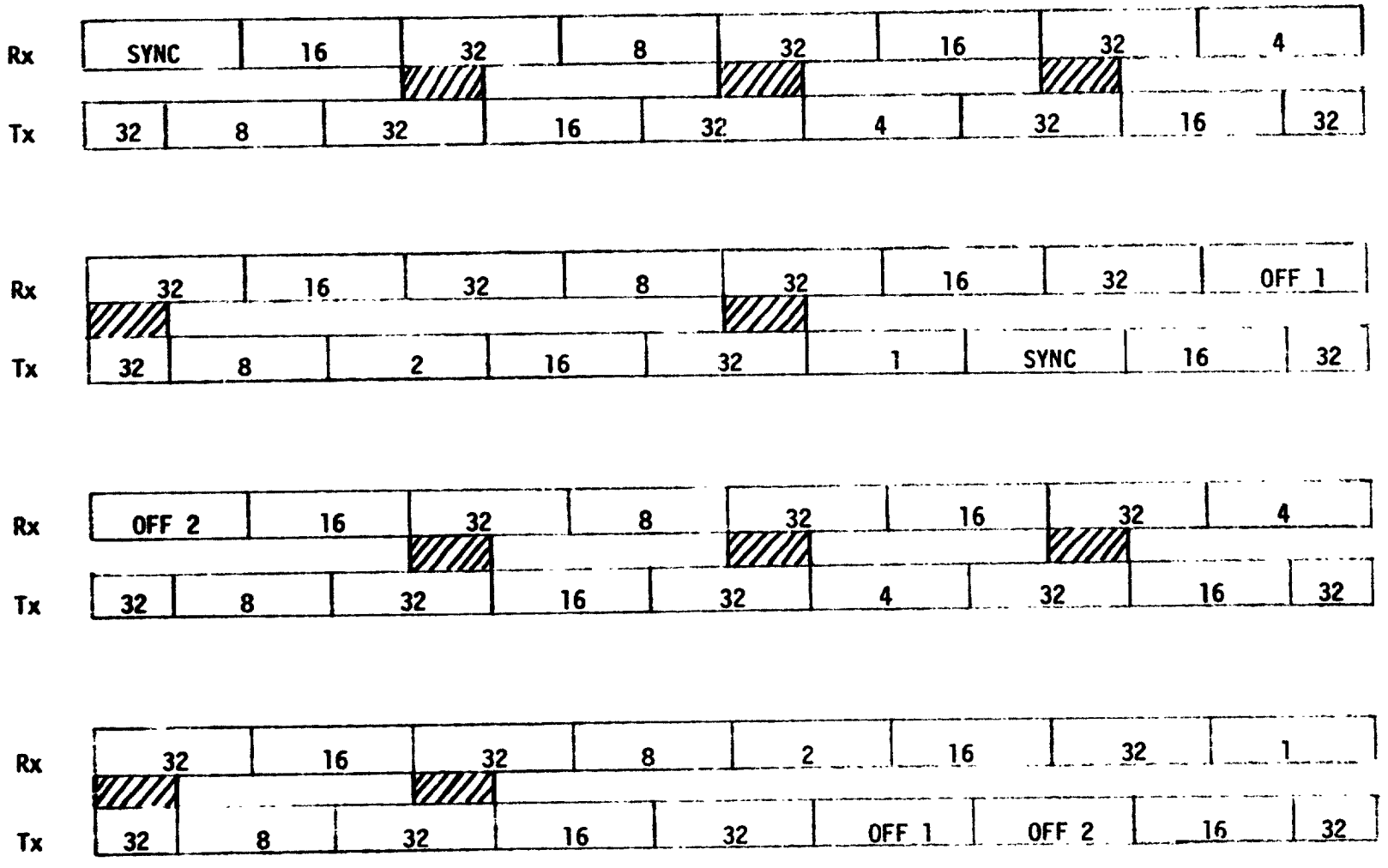


FIG. #2 SEP RECEIVER AND TRANSMITTER TIMING AFTER FALSE RESET PULSE

APPENDIX G

APPENDIX H

MEMO

To: Distribution

From: J.D. Redman

SUBJECT: Discussion of Calibration Data and Transmitter-Off Data Recovered from the SEP Lunar Data

Calibration Data:

An internal noise source in the form of a noise diode was provided in the SEP receiver to give a known power level that was measured during each Data Subframe and that was alternated between the different SEP frequencies in successive Data Subframes. This internal reference when recovered from the recorded data would give some confidence that the receiver was performing as expected. Because the noise diode output is not exactly repeatable over the short term (i.e. 11 msec. sample period) it is not useful as a direct calibration but functions more as an indicator that the receiver is operating normally. During this same period when the noise sources were measured the receiver front end noise was monitored by disconnecting the inputs.

The calibration data were measured before the mission in the Thermal Vacuum tests at low (15°F), ambient (66°F) and high (112°F) temperatures. The measurements were taken in terms of the VCO output frequency. All the data of interest

which is the data taken while the Receiver was in Mode 2 during EVA 2 is in the temperature range 84°F to 95°F. The Thermal Vacuum test data were interpolated to calculate the relevant Noise Diode VCO output frequency at these intermediate temperatures. In this way it was possible to compare the earth based measurements from the Thermal Vacuum tests with the recovered Lunar data. For each noise diode measurement the difference from the earth based measurements was calculated. The average of all these differences, referred to as the mean error was computed for each SEP frequency along with the standard deviation of this mean error. This data is given in table #1.

The mean errors for the Noise Diode at the lower SEP frequencies are larger than its standard deviation and thus the differences are probably real. The Noise Diode +20 db measurements do not have siginificant mean errors. An important aspect of this data is that all the mean errors are positive. That is, the Lunar data gives apparently higher VCO output frequencies than the data measured during the Thermal Vacuum tests. It is possible that this is an artifact produced in the data reduction procedure. This mean error is plotted as a function of the VCO output frequency in Figure #1 for the Noise Diode and the Noise Diode +20 db data. This plot is possible because the Noise Diode VCO output frequencies are different for the different SEP frequencies.

The Receiver Front End Noise data are given in table #1. The power levels at 16 mhz and 32 mhz are significantly higher than the values measured during the Thermal Vacuum tests. These anomalously high values will be discussed later with respect to the transmitter-off data.

In conclusion the Noise Diode calibration data gives apparently different VCO output frequencies from those measured before the mission and the Noise Diode +20 db calibration data is in agreement with the pre-mission measurements.

Transmitter-Off Data:

The data that will be discussed here is for the section of the traverse from the SEP transmitter site out to a range of 1.6 km. There has always been some concern that electromagnetic noise generated by the Lunar Rover systems such as the drive, and steering motors and brakes would be of a high enough power level to interfere with the signal from the SEP transmitter or any cosmic noise components. For this reason, measurements were made of the EMI levels generated by the LRV on the earth during the LRV/LCRA mission simulation and baseline data tests for Apollo 16. These tests were the subject of two memos (March 8/72, Reduction and Interpretation of Data from the SEP Receiver Taken During the LRV EMI Tests and June 6/72, Some Final Comments on the LRV EMI Tests) which were included in the U of T monthly reports.

From the analyses of the data taken during these tests it was found that during periods of driving, steering and braking interference was generated that was 11 db above the normal background level at 32 mhz, 17 db above the background level at 16 mhz, and 8 db above the background level at 8 mhz. The other frequencies had no perceptible increase in noise levels during these periods. The 16 mhz data had a constant noise level 9 db above the background even when the LRV was not driving.

The Transmitter-Off data from Lunar TAPE #SEP009has been separated into two groups; one for data taken when the LRV was moving and the other for data taken when the LRV was stopped. There are approximately 10 data points for each antenna and frequency combination in the data group for the LRV stopped and about 40 points for the LRV moving. Statistics computed from these two sets of data is given in table #2. This data is also presented in graphical form in figures 2, 3 and 4, where the average received power levels for the two data groups and for the Receiver Front End Noise have been plotted at the different SEP frequencies. In figures 5 through 10 histograms are given for each SEP frequency and receiving antenna. The received power levels were divided into 2.5 dbm intervals and the number of measurements in each interval were counted. All the data was then normalized to the same total number of measurements.

It is clear from this data that the average background levels are higher when the LRV is moving than when it is stopped. Presumably the source of this noise is from the LRV systems such as the drive and steering motors. The background noise when the LRV is stopped is as expected. That is, it is higher than the receiver front end noise levels; however the 32 mhz receiver input noise is higher than the background noise levels for some unknown reason. The 16 mhz data has a constant higher noise level even when the LRV is stopped indicating that the source is something other than the LRV drive motors. This noise was also observed in the data from the Apollo 16 LRV EMI tests and was attributed to some unknown external source.

In figures 11 through 16 the Transmitter-Off data have been plotted as a function of the LRV velocity. There is a trend indicating that the increasing velocity results in increasing background noise levels which would be expected from the increasing drive motor currents required at the higher velocity. This is particularly evident for the 16 mhz data.

When the LRV is moving there is an increase in the background noise level caused by the LRV drive systems that is evident on the histograms at all the SEP frequencies. Therefore, any received power levels that are more than 2σ higher than the average receiver front end noise levels

are probably due to LRV sources (driving, steering and braking systems) and cannot be attributed to any cosmic noise sources. If there is any cosmic noise that is detectable it would only be seen when the LRV is stopped.

In figure #17, the data group for the LRV stopped is presented in another format. The average power and the standard deviation for the Receiver Front End Noise was computed. The total number of data points that were in the intervals $-\sigma$ to $+\sigma$, σ to 2σ, 2σ to 3σ, 3σ to 4σ and 4σ to ∞ were normalized and plotted for the different SEP frequencies. The expected values for a Normal distribution have also been plotted for comparison. The 32 mhz data was not included here because the average value of the Receiver Front End Noise is anomalous at this frequency in that the power level is higher than the Tx-Off power levels.

From this data it appears probable that there is some received power levels significantly above the Receiver Front End Noise at 2 mhz, 8 mhz and 16 mhz when the LRV is stopped. The source of these signals could be the LRV systems or cosmic noise. During the LRV EMI tests on the Earth for the Apollo 16 LRV the only SEP frequency that had siginificant interference, when the LRV was stopped, was 16 mhz but it was concluded that the source of this noise was not the LRV since it was present even when none of the LRV systems were operating. Before a more definitive statement can be made as to the source of this noise power it will be necessary to analyse in detail the Tx-Off data from the Apollo 17, LRV EMI tests.

TABLE #1 CALIBRATION DATA EVA-II

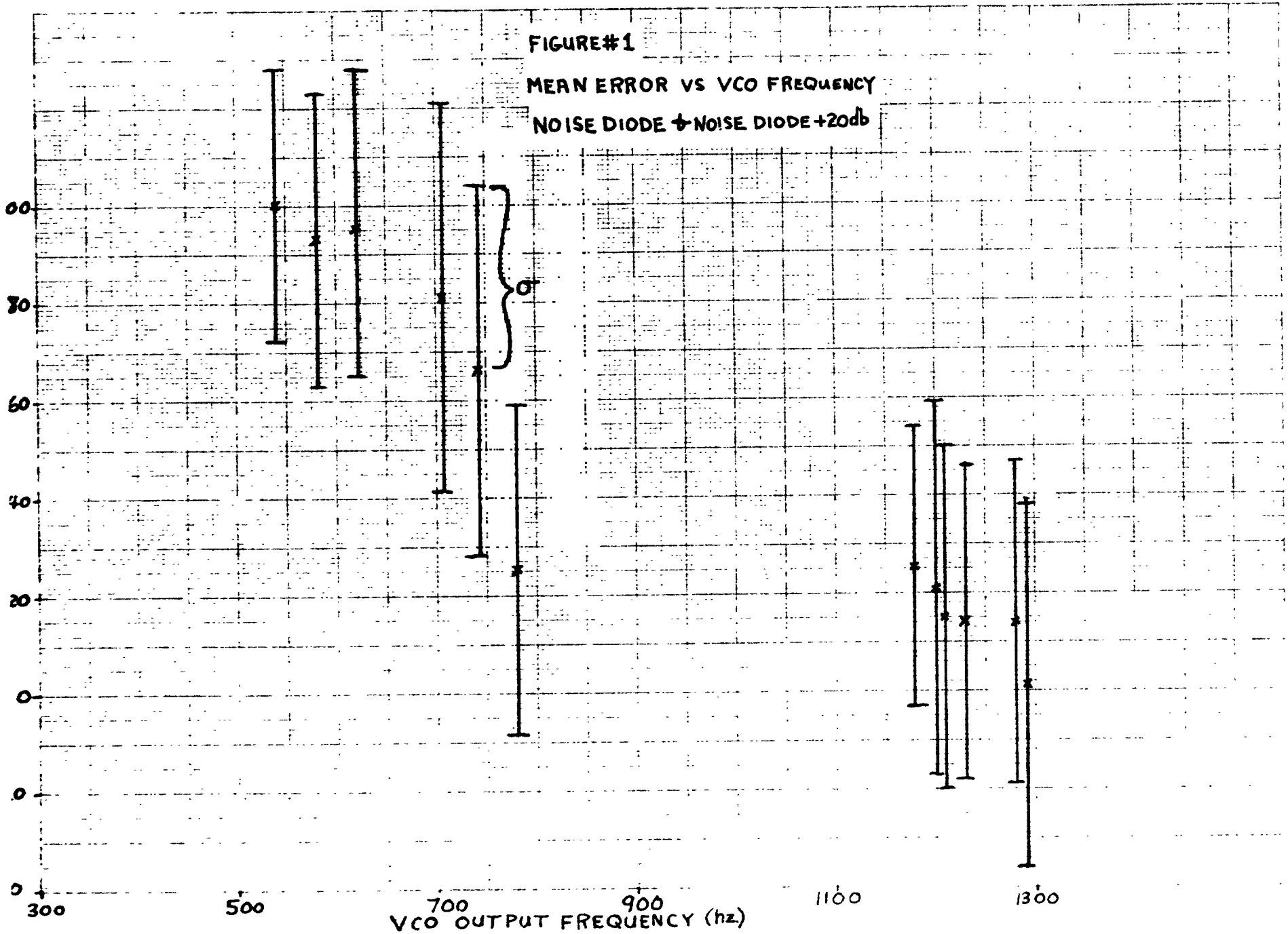
Frequency mhz	NOISE DIODE Mean Error(hz)	NOISE DIODE σ for Mean Error(hz)	NOISE DIODE +20db Mean Error(hz)	NOISE DIODE +20db σ for Mean Error(hz)	R_x INPUT NOISE Lunar Data Mean(hz)	Lunar Data σ(hz)	Thermal Vacuum 50Ω Term
1	100	28	25	28	332	12	323
2	94	30	15	35	333	14	333
4	95	33	14	32	332	12	328
8	81	40	3	37	356	15	311
16	66	38	14	33	406	24	310
32	25	34	21	38	408	16	307

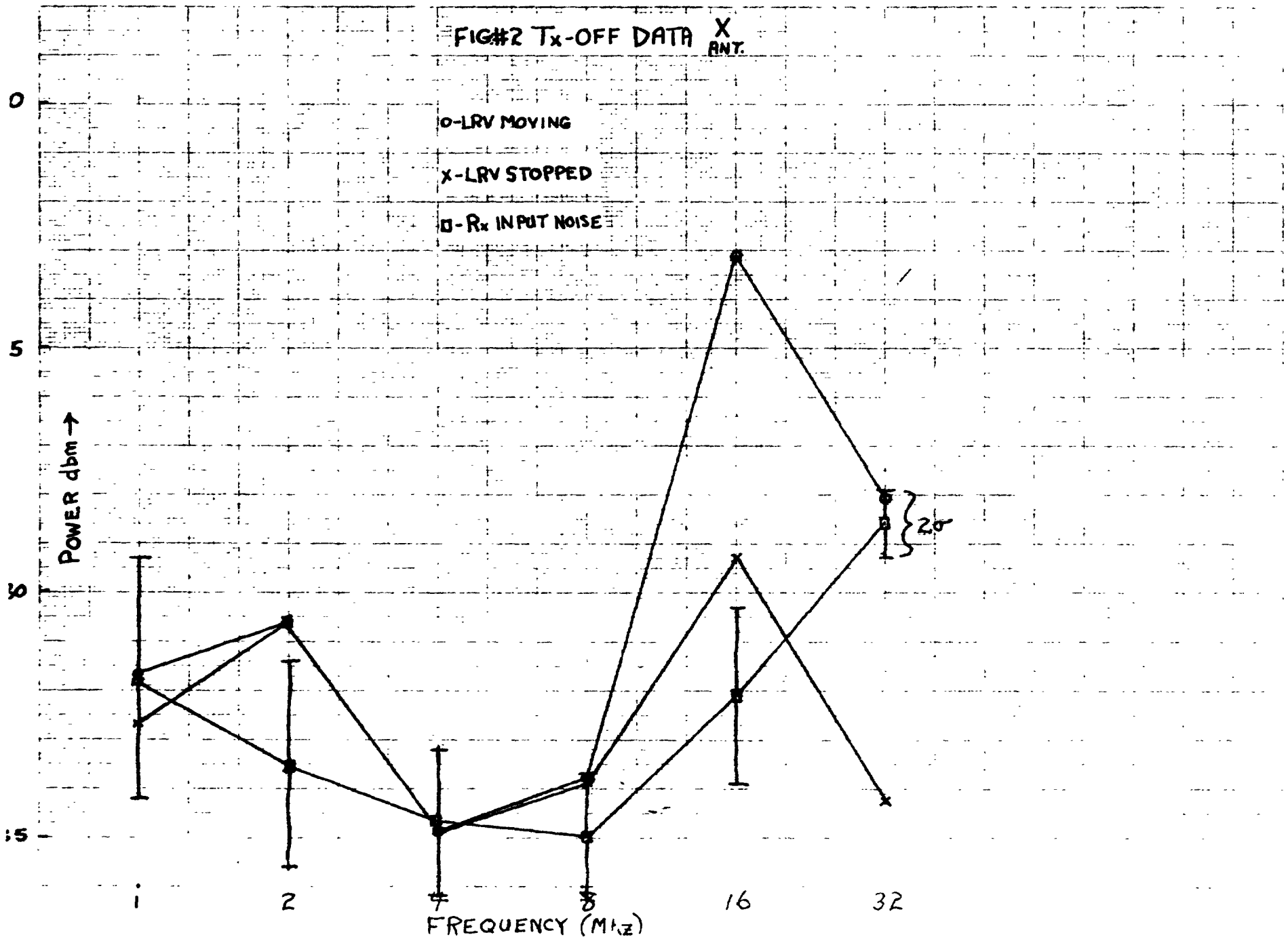
TABLE #2 TRANSMITTER-OFF DATA STATISTICS

Freq.	Average X dbm		σ_x dbm		Maximum dbm		Minimum dbm	
mhz	Moving	Stopped	Moving	Stopped	Moving	Stopped	Moving	Stopped
1	-131.7	-132.7	+1.73 -2.16	+1.05 -1.20	-126.0	-130.8	-134.6	-134.6
2	-130.6	-130.6	+1.51 -1.83	+1.37 -1.63	-127.1	-128.5	-134.2	-133.3
4	-134.9	-134.9	+ .17 + .17	0 0	-134.8	-134.9	-134.9	-134.9
8	-133.8	-133.9	+1.08 -1.23	+1.03 -1.17	-131.5	-131.6	-135.0	-135.0
16	-123.1	-129.3	+2.20 -2.96	+2.63 -3.80	-119.0	-124.8	-130.4	-132.7
32	-128.1	-134.3	+3.02 -4.66	+ .55 - .58	-121.1	-133.0	-134.6	-134.6

Freq.	Average Y dbm		σ_y dbm		Maximum dbm		Minimum dbm	
mhz	Moving	Stopped	Moving	Stopped	Moving	Stopped	Moving	Stopped
1	-128.2	-133.1	+2.96 -4.53	+1.91 -2.46	-120.0	-128.1	-134.6	-134.6
2	-125.1	-129.8	+2.33 -3.19	+2.27 -3.08	-119.0	-124.1	-128.9	-134.2
4	-133.2	-134.9	+1.83 -2.46	0 0	-128.8	-134.9	-134.9	-134.9
8	-129.5	-133.4	+1.61 -1.98	+1.86 -2.37	-125.1	-129.4	-134.3	-135.0
16	-119.1	-126.8	+2.21 +2.96	+3.75 -6.74	-115.7	-120.2	-126.7	-132.8
32	-126.1	-133.0	+2.62 -3.77	+2.93 -4.43	-121.6	-126.7	-134.6	-134.6

Freq.	Average Z dbm		σ_z dbm		Maximum dbm		Minimum dbm	
mhz	Moving	Stopped	Moving	Stopped	Moving	Stopped	Moving	Stopped
1	-130.3	-131.9	+2.54 -3.60	+2.47 -3.46	-123.2	-125.6	-134.2	-134.6
2	-128.2	-131.3	+2.88 -4.33	+1.85 -2.36	-122.1	-126.4	-133.7	-133.4
4	-134.0	-134.9	+1.98 -2.57	0 0	-126.8	-134.9	-134.9	-134.9
8	-132.4	-133.3	+1.74 -2.18	+1.99 -2.59	-128.8	-129.0	-135.0	-135.0
16	-129.7	-132.5	+1.51 -1.83	+ .76 - .84	-127.1	-131.0	-133.2	-133.5
32	-133.3	-134.6	+2.12 -2.81	0 0	-126.6	-134.6	-134.6	-134.6


FIGURE#1
MEAN ERROR VS VCO FREQUENCY
NOISE DIODE & NOISE DIODE +20db
σ
00
80
60
40
20
0
.0
0
300
500
700
900
1100
1300
VCO OUTPUT FREQUENCY (hz)


FIG#2 Tx-OFF DATA X ANT.
o-LRV MOVING
X-LRV STOPPED
□-Rx INPUT NOISE
0
5
10
15
POWER dbm
2σ
1
2
4
8
16
32
FREQUENCY (MHz)

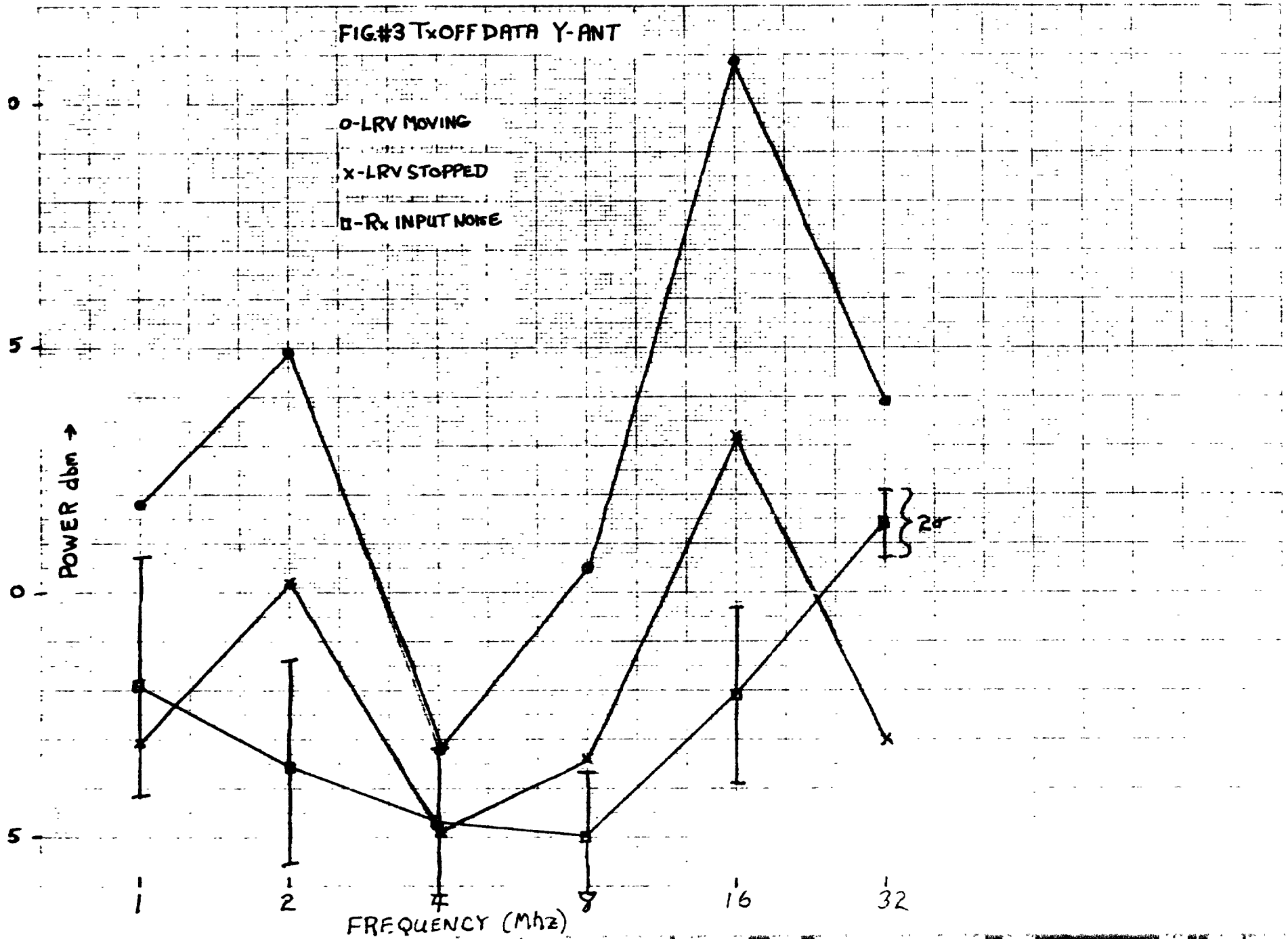
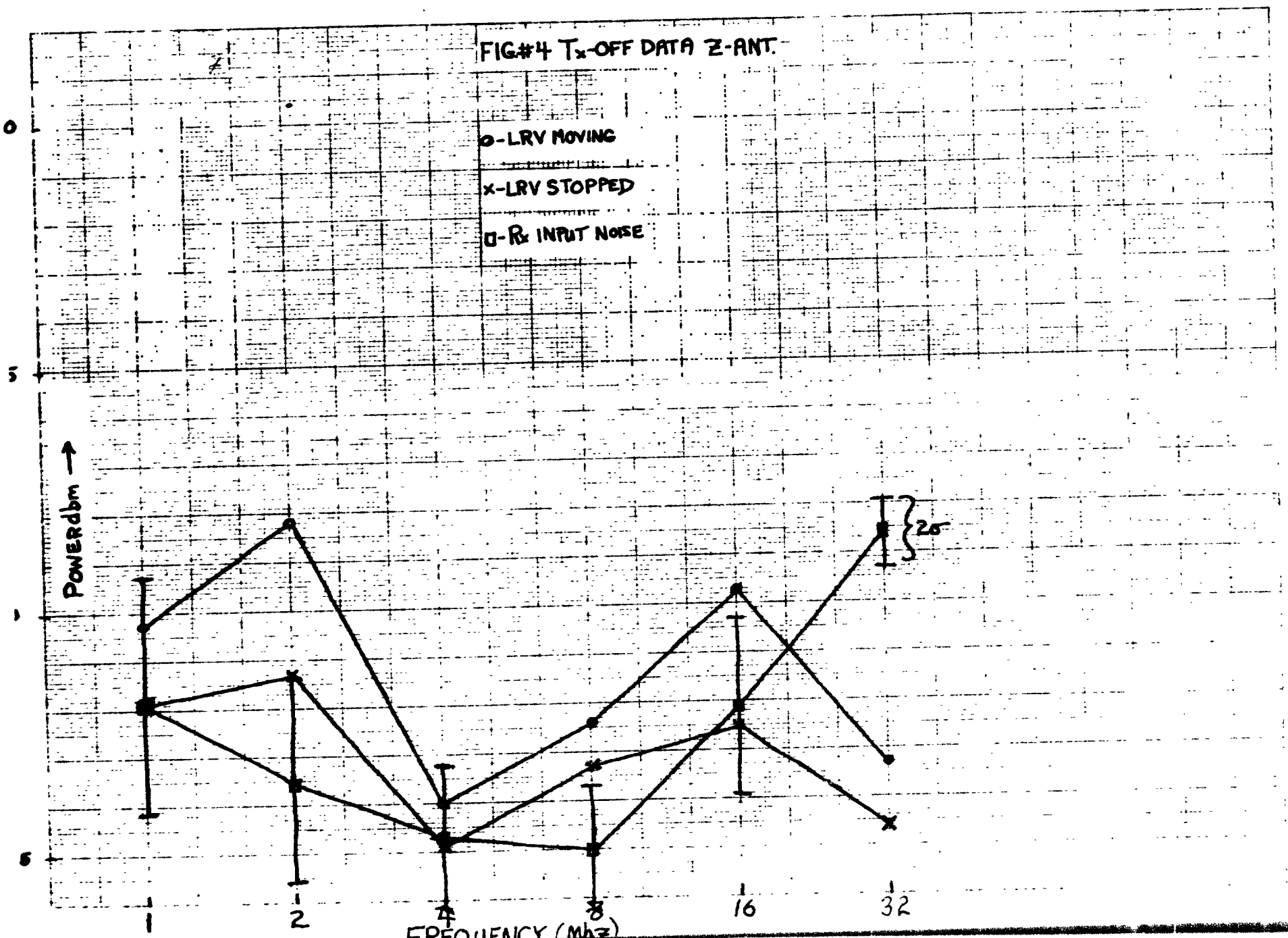
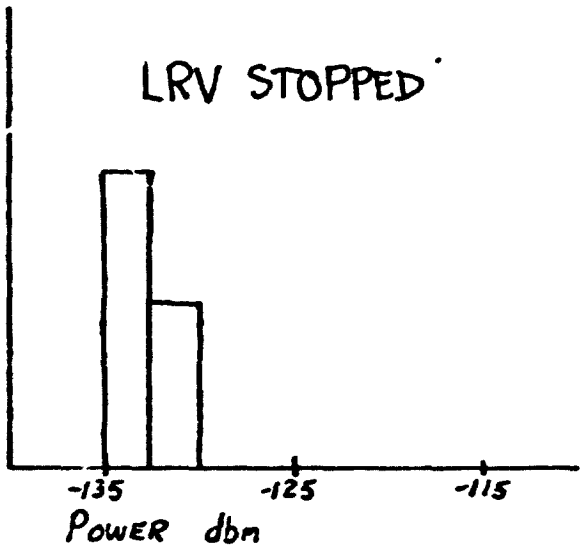


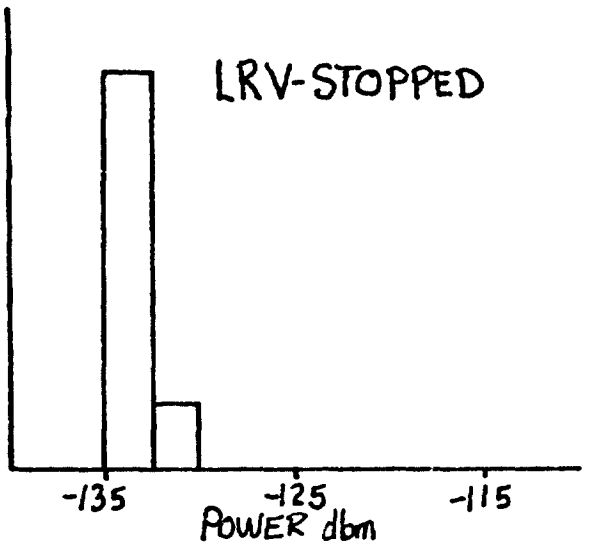
FIG.#3 TxOFF DATA Y-ANT
o-LRV MOVING
x-LRV STOPPED
□-Rx INPUT NOISE
0
5
0
5
POWER dbm →
2σ
1
2
4
8
16
32
FREQUENCY (Mhz)


FIG#4 Tx-OFF DATA Z-ANT.
o-LRV MOVING
x-LRV STOPPED
□-Rx INPUT NOISE
0
5
1
6
POWERdbm
20
1
2
4
8
16
32
FREQUENCY (Mhz)

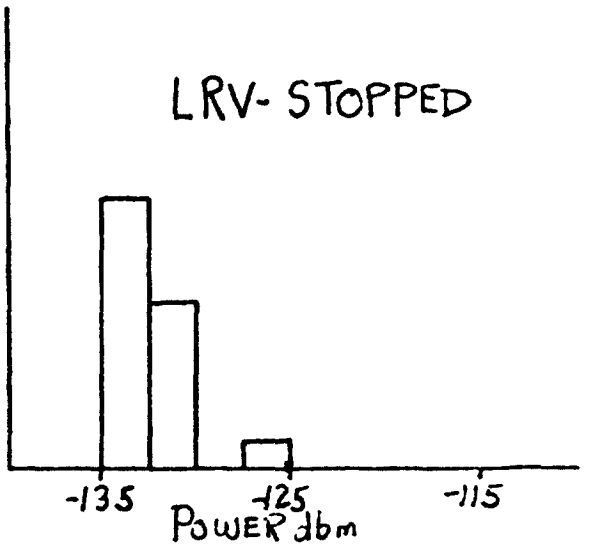
X-ANT.

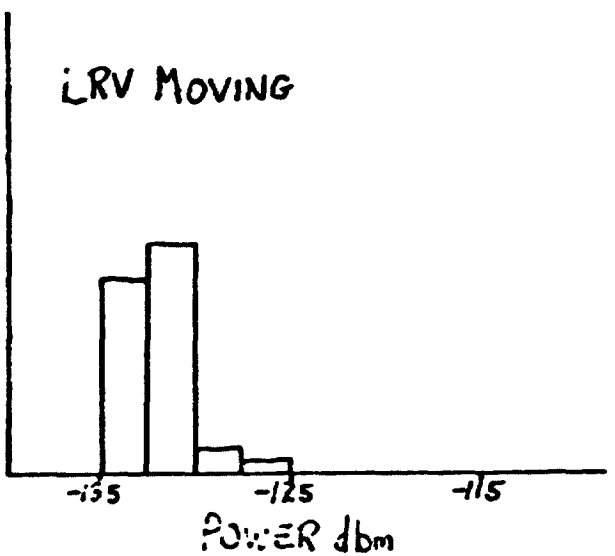


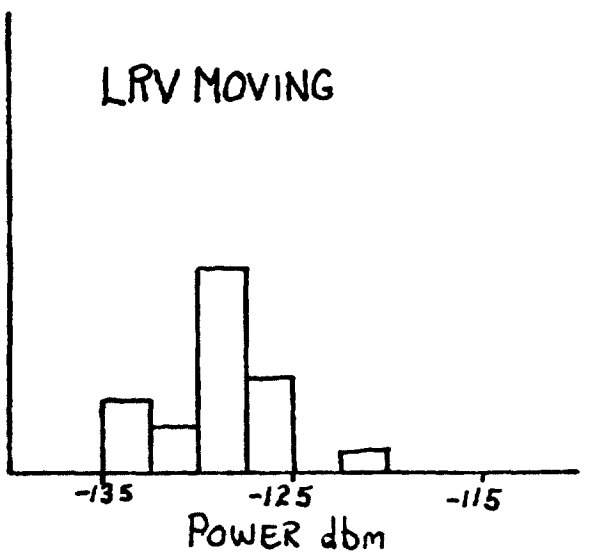
Y-ANT.



Z-ANT.







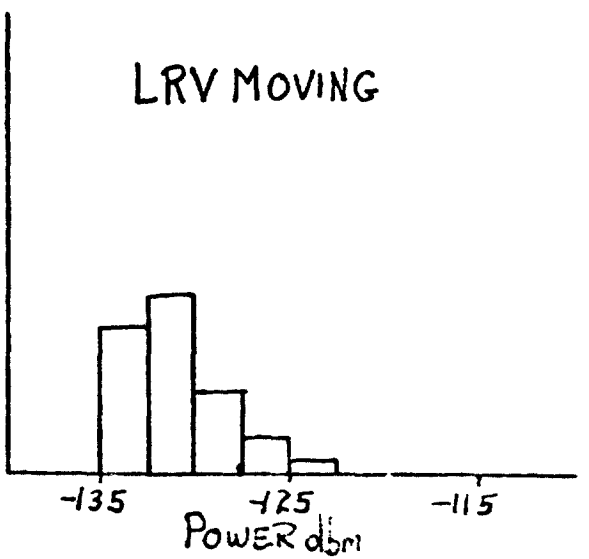


FIGURE #5 Tx-OFF DATA 1 Mhz.

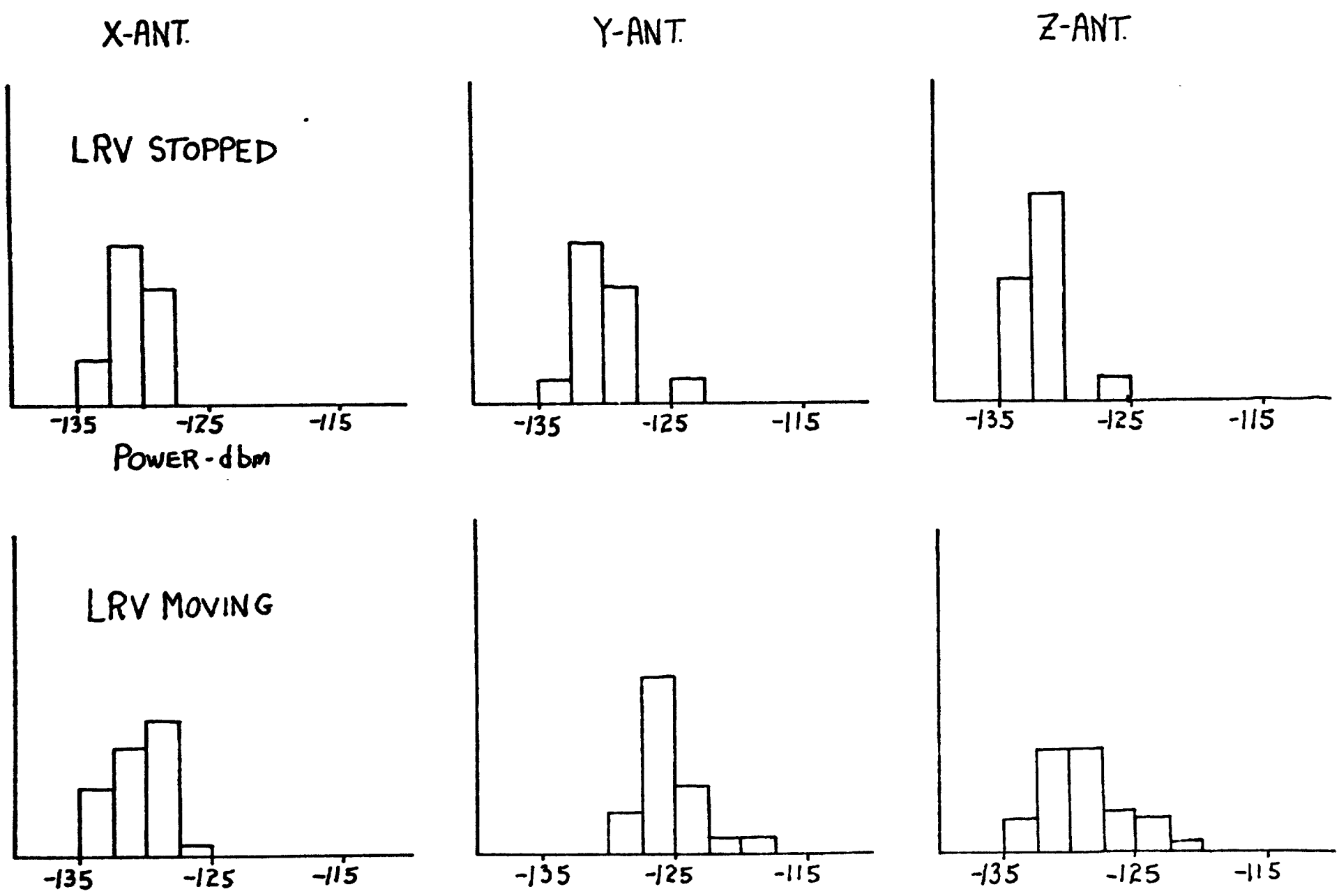


FIGURE #6 Tx-OFF DATA 2 Mhz

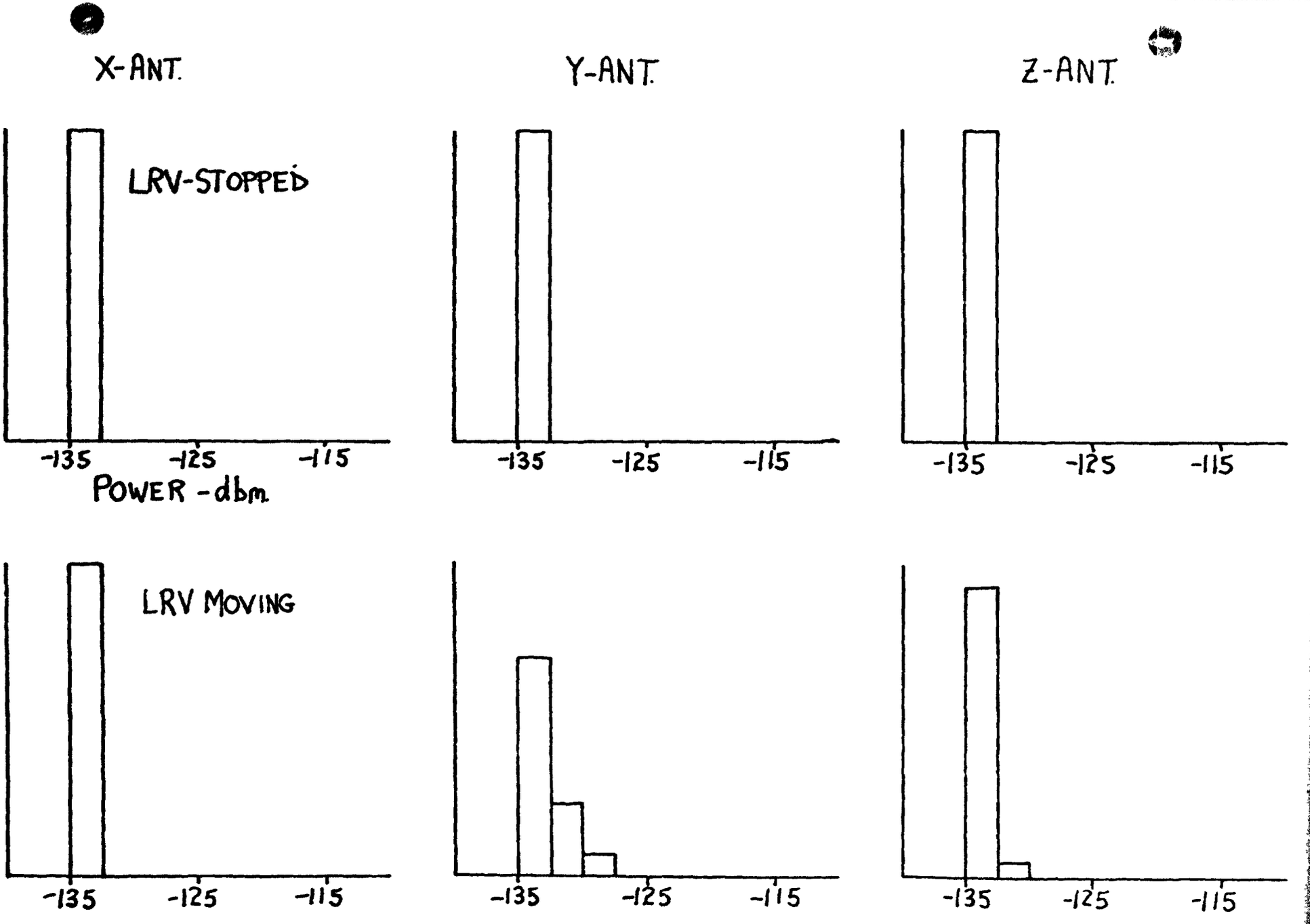


FIGURE #7 Tx-OFF DATA 4 Mhz

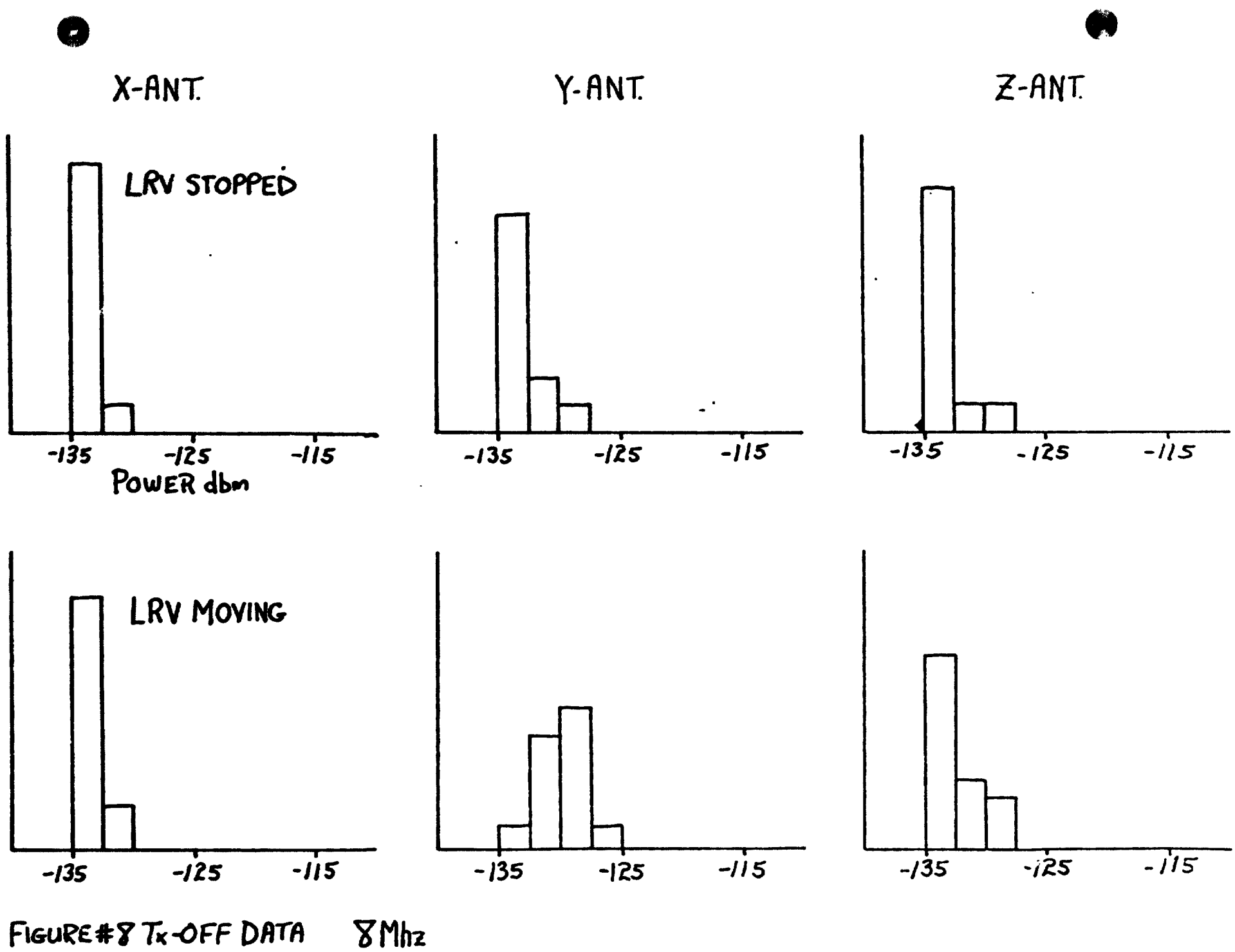


FIGURE #8 Tx-OFF DATA 8 Mhz

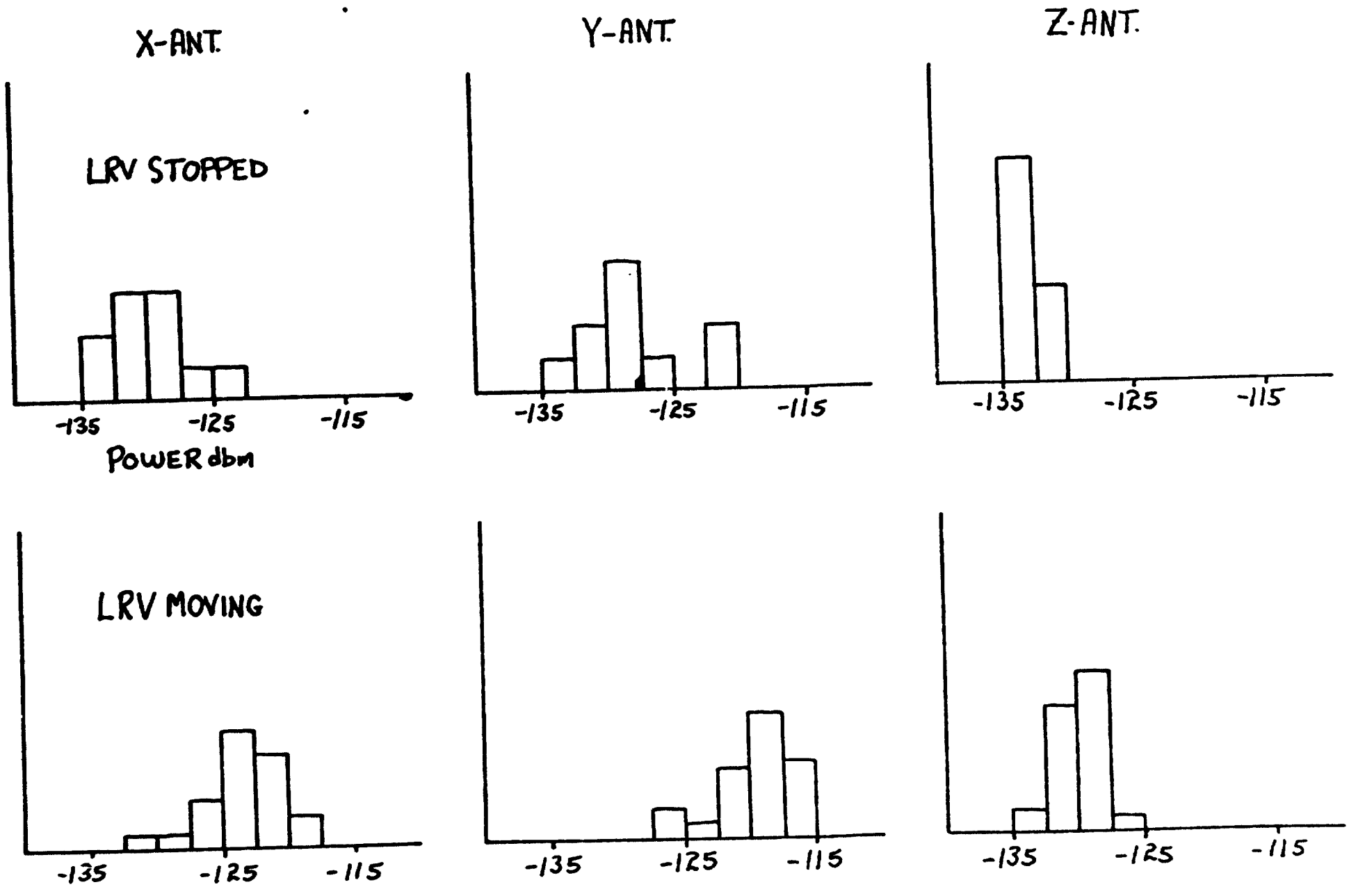


FIGURE #9 Tx-OFF DATA 16Mhz

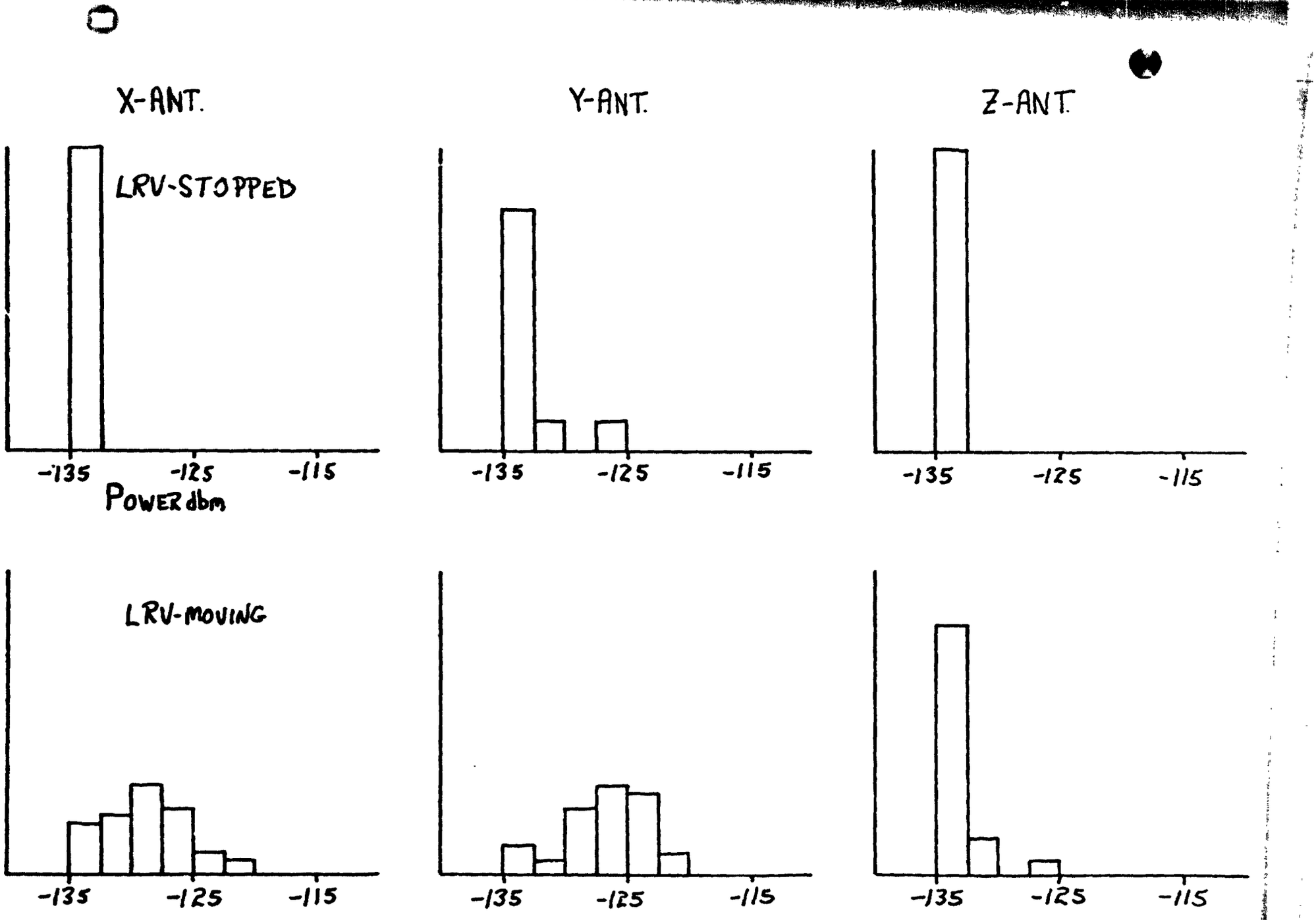


FIGURE # 10 Tx-OFF DATA 32 Mhz

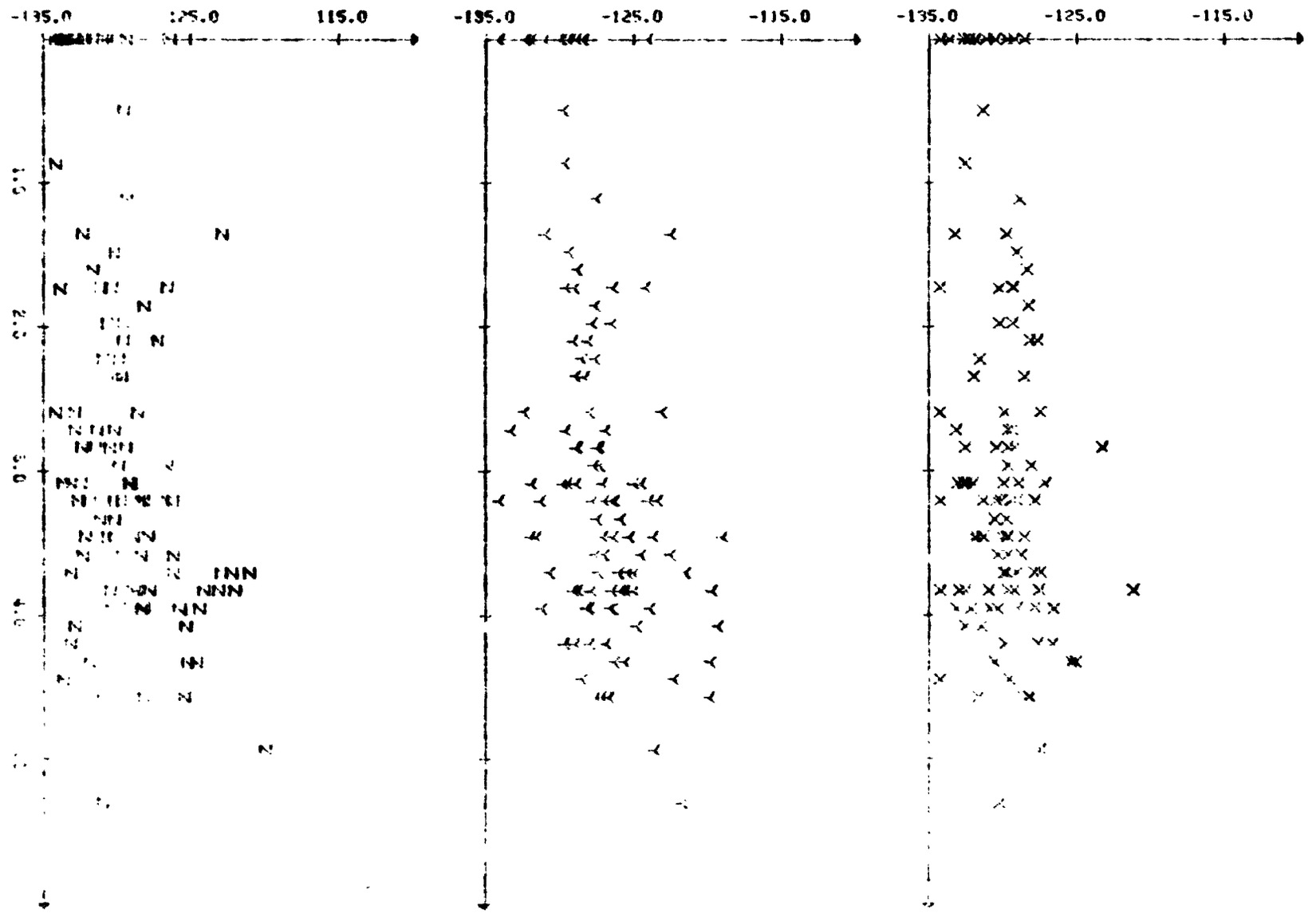
1 MHZ. APOLLO 17

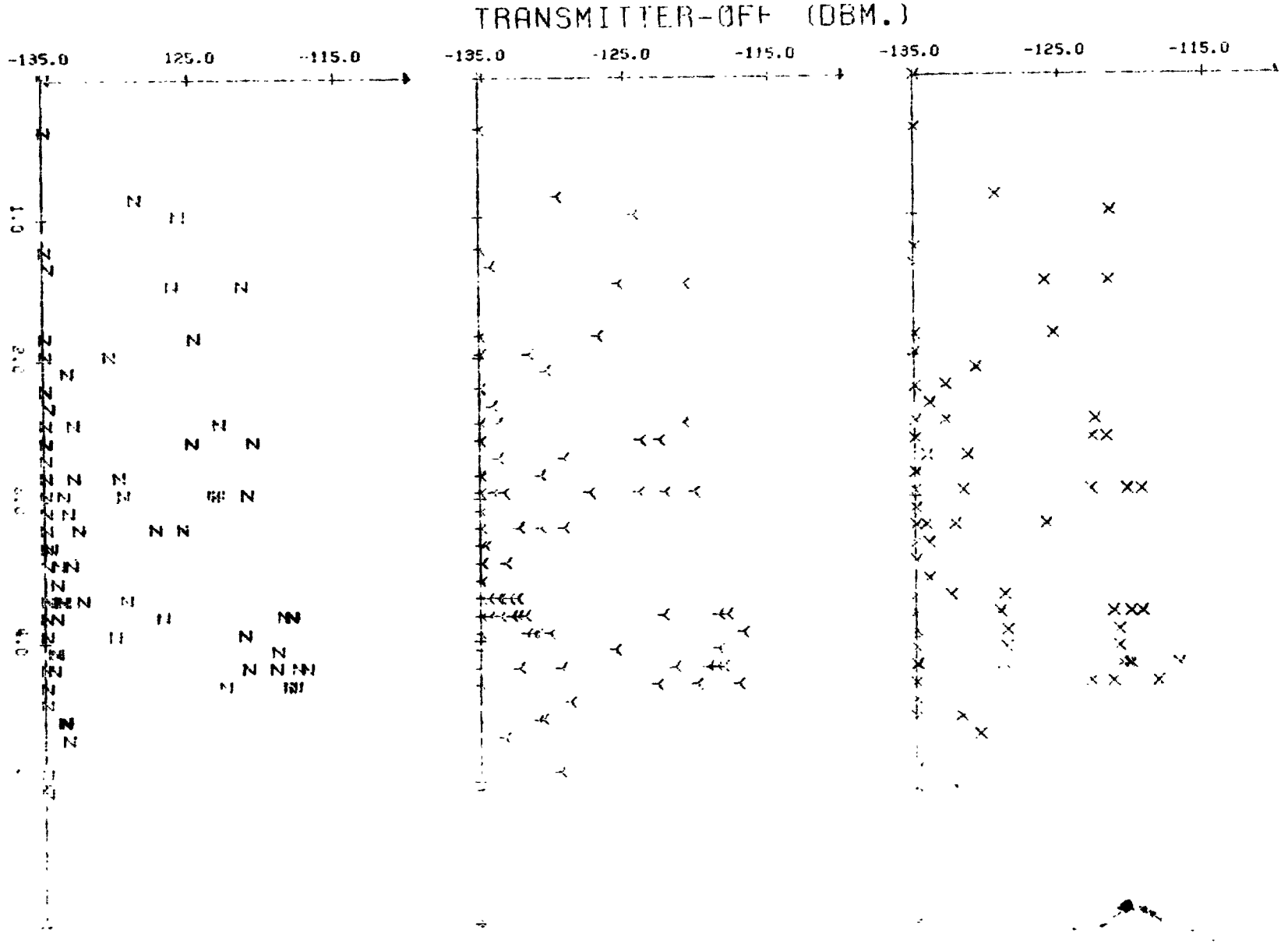
TRANSMITTER-OFF (DBM.)

-115.0
-125.0
-135.0

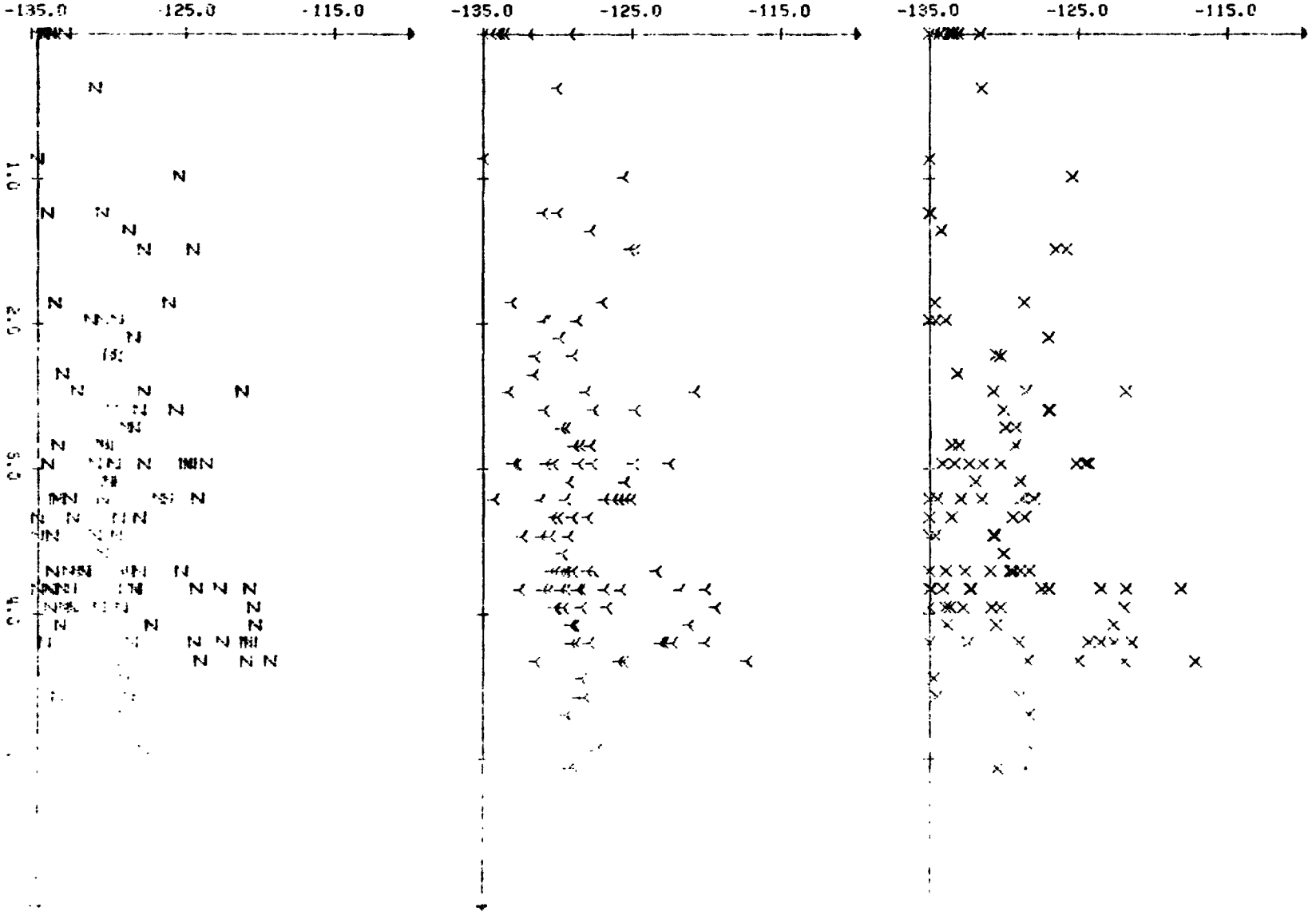
-115.0
-125.0
-135.0

-115.0
-125.0
-135.0


TRANSMITTER-OFF (DBM.)
-135.0
-125.0
-115.0
-135.0
-125.0
-115.0
-135.0
-125.0
-115.0
2 MHZ.


TRANSMITTER-OFF (DBM.)
-135.0
-125.0
-115.0
-135.0
-125.0
-115.0
-135.0
-125.0
-115.0

TRANSMITTER-OFF (DBM.)



8 MHZ.

16 MHZ.

TRANSMITTER-OFF (DBM.)

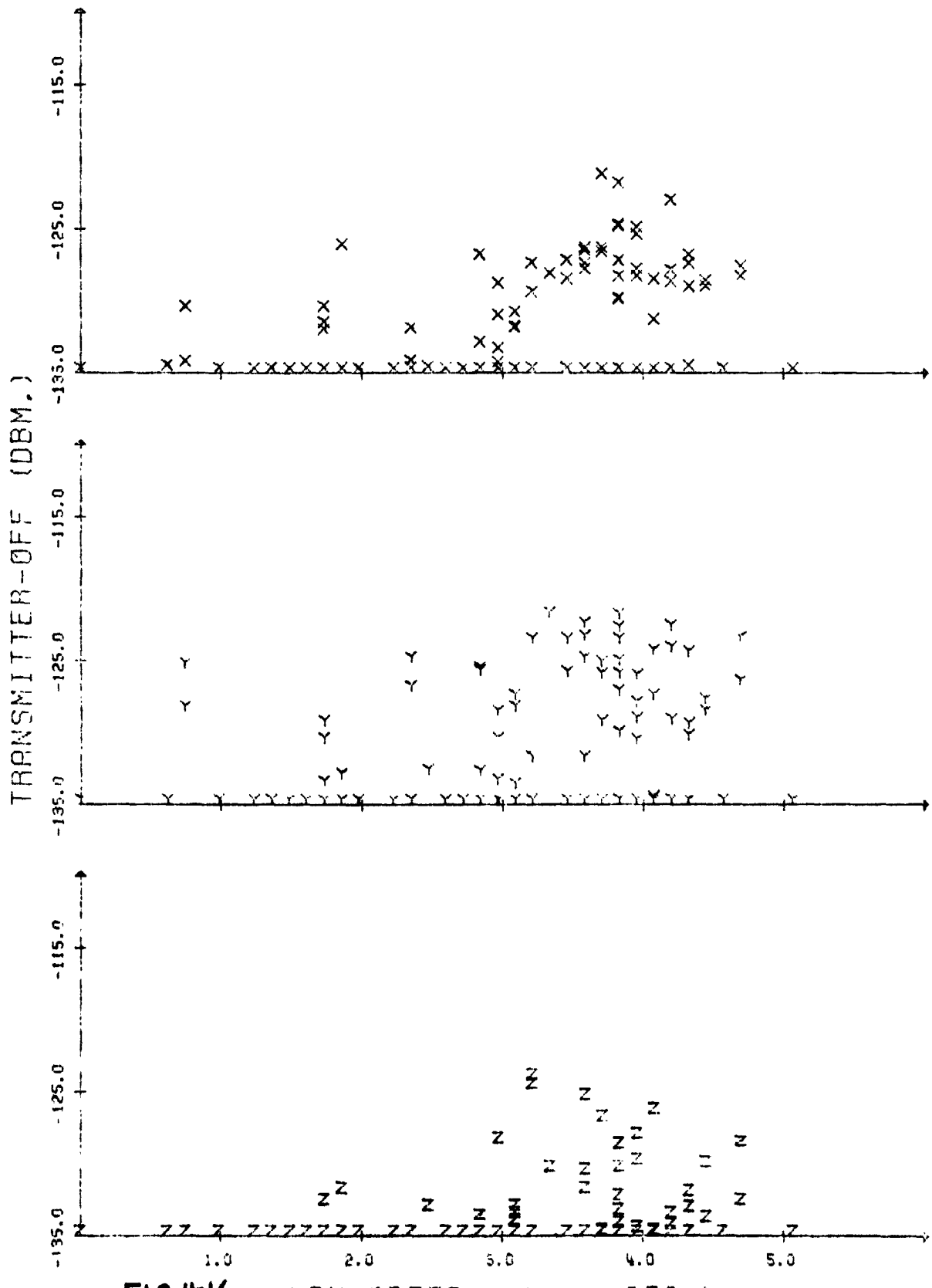
-115.0
-125.0
-135.0

-115.0
-125.0
-135.0

-115.0
-125.0
-135.0

1.0
3.0
5.0

FIG#15 LRW SPEED (N / SEC.)


32 MHZ. APOLLO 17
TRANSMITTER-OFF (DBM.)
-115.0
-125.0
-135.0
1.0
2.0
3.0
4.0
5.0
LRV SPEED (M. / SEC.)

FIG#16

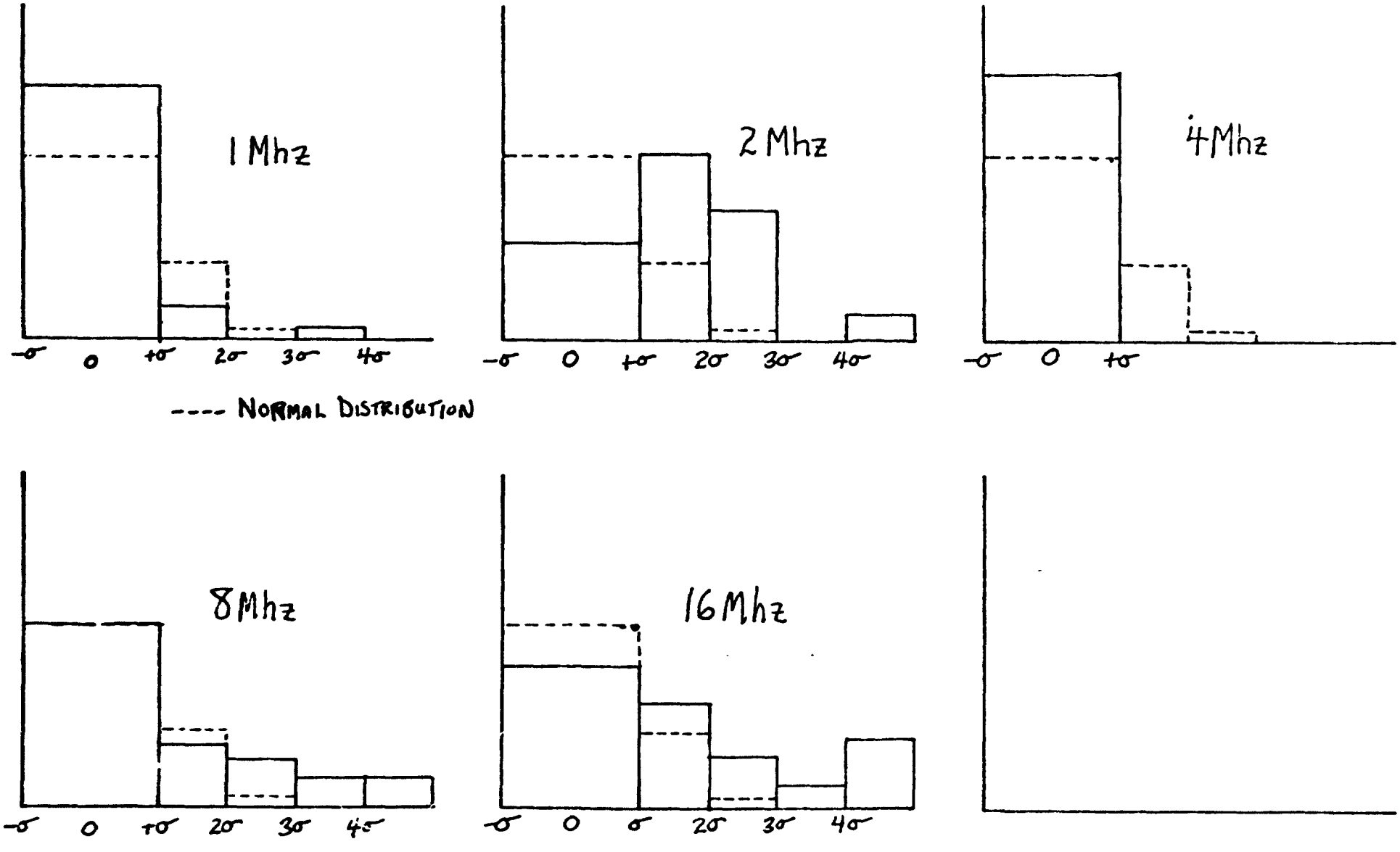


FIG. #17 TX-OFF DATA - LRV STOPPED - DEVIATION FROM R_x INPUT NOISE DISTRIBUTIONS

DIGITAL PROCESSING

The Data Acquisition system could be optimally operated for processing navigation data or science data but not both simultaneously. The final DAS digital tapes were therefore different for the two types of data. They were:

FINAL NAV TAPE	FINAL SCIENCE TAPES
SEP304	SEP400
	SEP401
	SEP402
	SEP403

Navigation and science data, coming from separate tapes, were processed separately. They were merged only in the final stages of processing, when they were as error-free as possible. The description of data processing is consequently divided into two parts which separately describe navigation and science data processing. The merging and converting to BCD format are described at the end of the section on science data processing.

NAVIGATION DATA PROCESSING

Figure 1 shows the processing flow for navigation data. Its format has been described in the report on data digitizing by the DAS. The nav data occupied the end of each record. The first program, NAVSTRIP, scanned tape SEP304, discarding science data and keeping only nav data. With no processing,

this was written into drum file SEP304-NAV.

For more efficient use of the drum and for greater ease in accessing the nav data on a bit-by-bit basis, it was reconstructed into equal-size blocks and written into drum file SEP304-BLOK by the REBLOK routine. This file, which still contained raw data, was made accessible on a bit-by-bit basis through the function subprogram RAWBIT. RAWBIT could return the value of any bit in a record of SEP304-BLOK on a random basis. Since SEP304-BLOK was a sequential file, however, the various records had to be accessed in ascending order.

The first documentary look at the navigation data was provided by the program BITBLAST. Through the vehicle of RAWBIT, a bit-by-bit dump of the navigation data was printed by BITBLAST. Because of the 7-bit repetition sequence in the nav data, bits were grouped by 7's. The alignment of the sync bit was obvious. Places where the sync bit was not 1 or where it changed position due to erroneous extra or missing bits were readily identified.

Manipulation of the navigation data started in the FINDERRORS routine. Given the position of the sync bit in a 7-bit group, this routine searched succeeding groups until a zero occurred in that bit position. At that point, either the sync bit was erroneously zero or it had shifted due to recording or digitizing problems. The data in the vicinity of

the anomaly was printed out in 7-bit groups. Visual inspection yielded the new sync position without difficulty. This was typed into the interactive routine (FINDERRORS), which proceeded as before up to the next sync error. This procedure guaranteed that no sync anomalies were overlooked.

Shifts in sync position implied the erroneous loss or insertion of bits. The function BIT/SEP304 was coded as a front-end routine for RAWBIT. It checked for calls for erroneous bits, intercepting the incorrect value which would be returned, and making whatever corrections seemed most appropriate. The ever-increasing shift which resulted from more and more missing bits was accounted for by adjusting bit numbers by a shift which was updated in each error region. This routine was checked by running it through the FINDERRORS routine, which verified that all readjusted sync bits were 1's. All missing bits but sync bits were set to 0 by BIT/SEP304.

Once the sync pattern had been made regular by BIT/SEP304, sync bits provided no information. The nav data, without sync bits, was copied to drum file SEP304-STACK by the RESTACK program. RESTACK used the BIT/SEP304 function, merely skipping every 7th bit. The six bits of each nav bit-group packed conveniently into the 36-bit 1108 word.

The now-restructured, corrected and compressed nav data were dumped in six-bit groups by STACKBLAST. This printout gave a completely regular bit pattern for manual study.

To compare with printouts produced by the Wang 720, and

to further identify possible errors, the times and accumulated counts of range, bearing, left and right odometers were printed by RBUPS for each update of range or bearing. These updates had been hand-checked by D. Redman on strip-chart records of the nav data. The only problem which was found was an erroneous range-down pulse. The routine FIXUP copied SEP304-STACK into a new file of the same name, deleting the erroneous bit. This updated SEP304-STACK was the final version of navigation data in bit form.

As a check on the accuracy of the data in SEP304-STACK, the COUNTER program totalled the odometer counts for each odometer, from the transmitter site to the stop and sync loss at 4.3 km. These totals agreed with D. Redman's totals calculated on the Wang 720.

Processing of the corrected raw navigation data in SEP304-STACK commenced with the computation of the "range-only wander factors", or ROWFs,by the program ROWF. ROWFs consist of the ratio of distance travelled, as calculated from the odometer, to the 100 m interval between range updates. ROWFs were calculated for each odometer, and were later applied in the use of the odometer as a range interpolator. They were stored in the drum file SEP304-ROWFS.

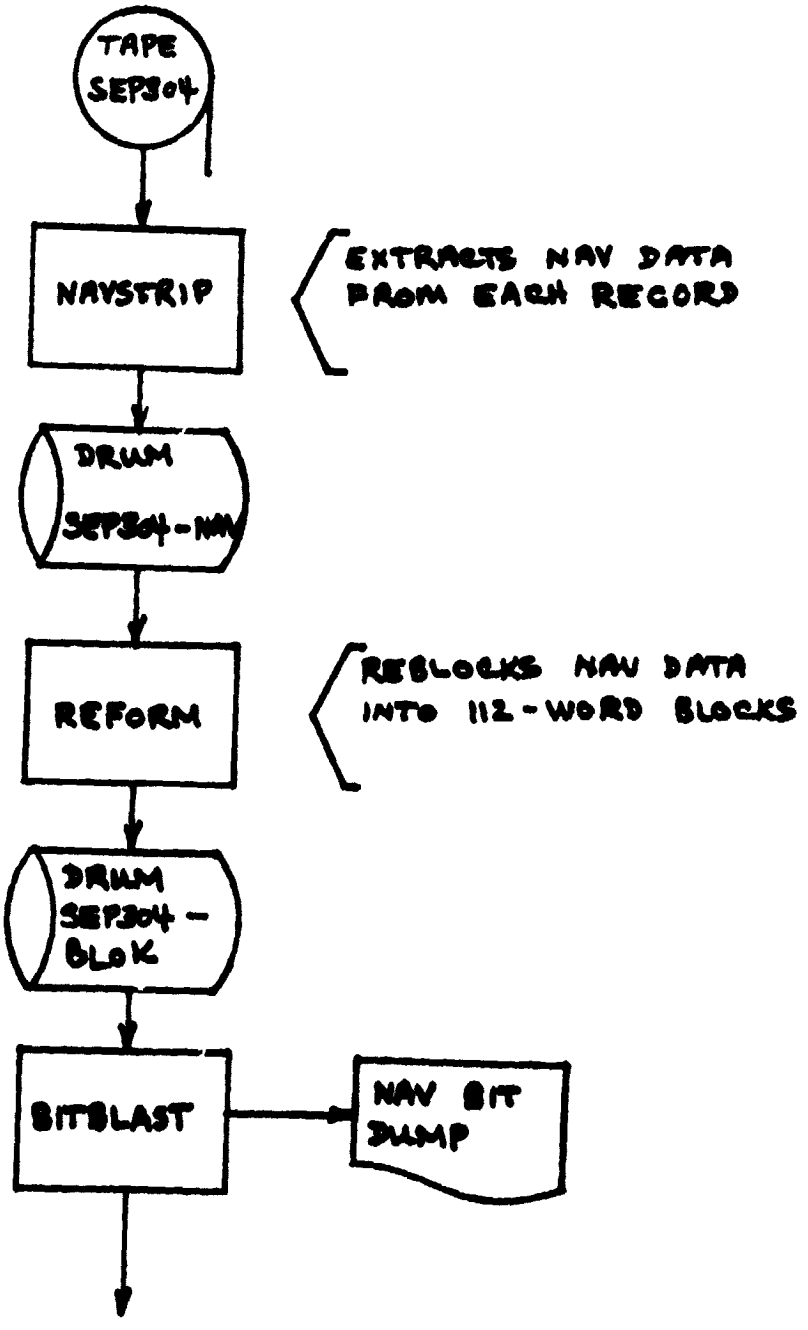
As an aid in finding times of Rover stops, and to obtain an indication of Rover speed, VELAN computed the average speed of each odometer wheel (right front and left rear) in

each 6.48 sec interval corresponding to a record. During deployment of Explosive Package 4 (EP-4) for the Lunar Seismic Profiling Experiment, the Rover was driven in a circle. The velocity discrepancy between left and right wheels during this turn was clearly seen.

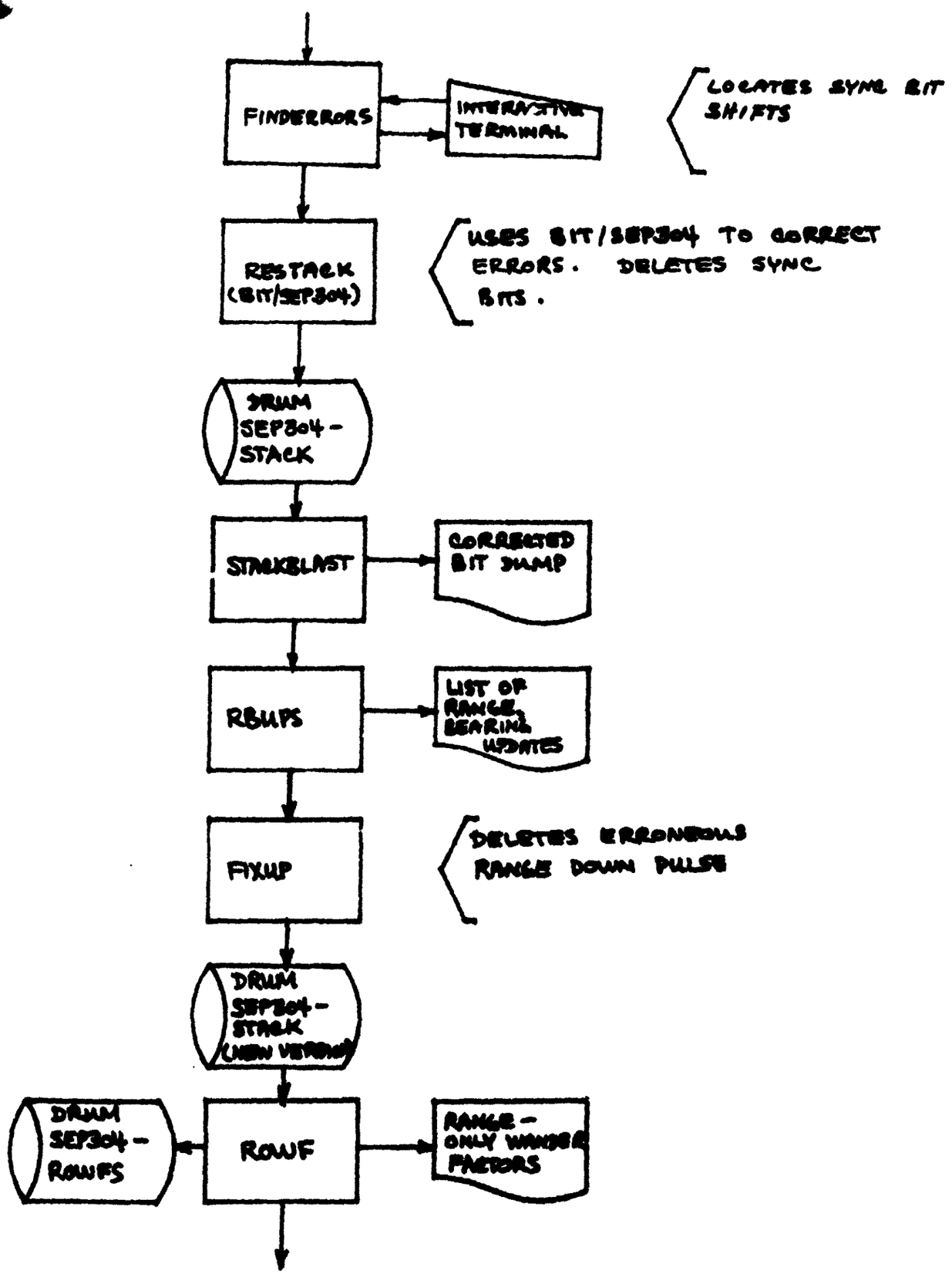
The process of estimating the range by using the odometer as an interpolater between range updates is valid only if the Rover is traveling approximately in a straight line. The one area where this was known not to be the case was during the turn at EP-4. The program ARROW deleted the odometer pulses during this turn, saving the modified nav data bit file as SEP304-ARROW. This file was used as input to the ROWF program to get a new set of range-only wander factors. The only difference between this set of ROWFs and the earlier one was in the immediate vicinity of EP-4. The new set of ROWFs was stored as ARROW-ROWFS.

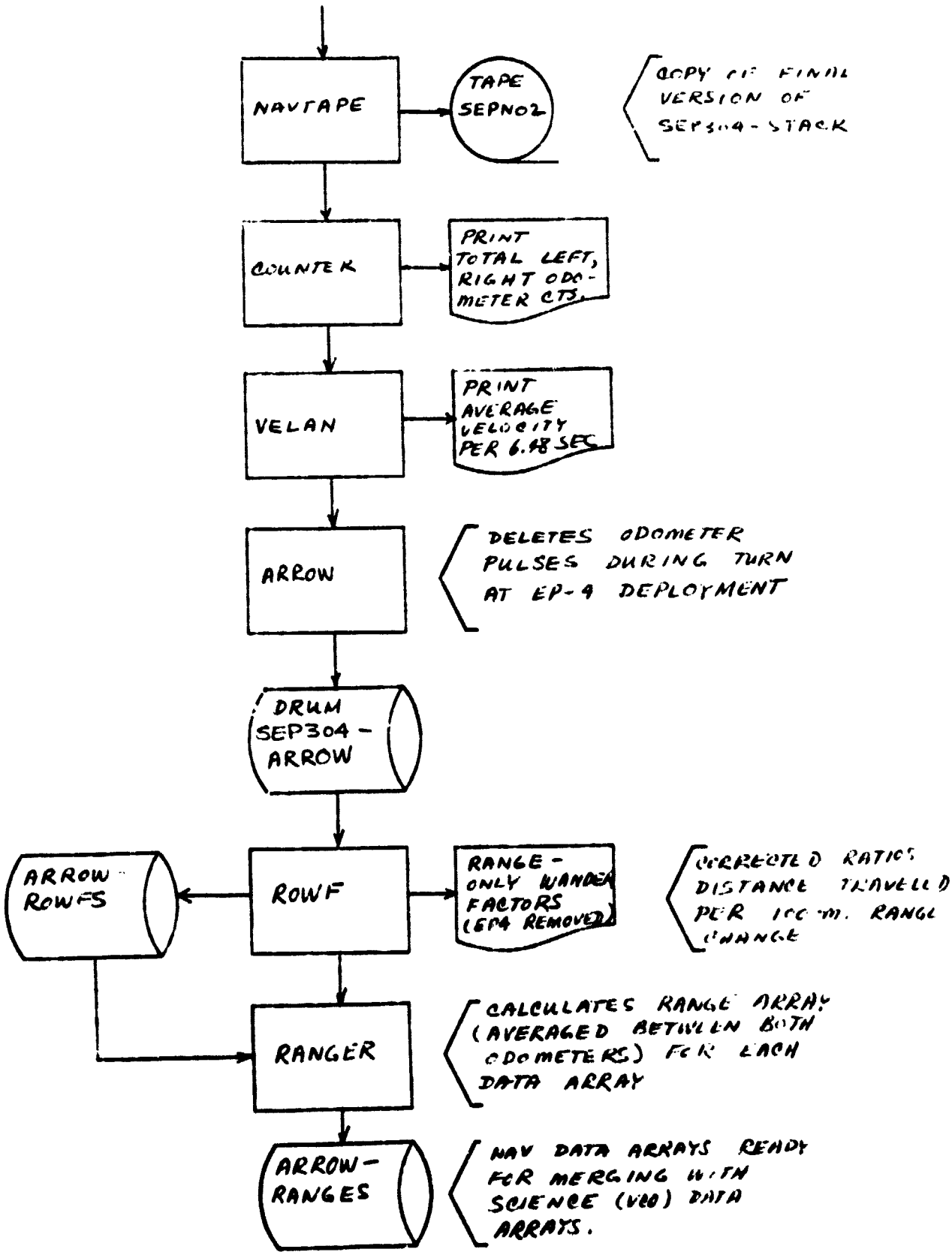
In preparation for merging with the science data, ranges were computed from SEP304-ARROW and ARROW-ROWFS by the program RANGER. RANGER used ARROW-ROWFS to interpolate between range updates using both left and right odometers. The mean range determination was used. Range was calculated for each 202.5 msec frequency-frame, from the transmitter site to 4.3 km. These ranges were stored on drum file ARROW-RANGES.

NAVIGATION DATA PROCESSING FIGURE 1



CONTINUED


FINDERRORS
INTERACTIVE TERMINAL
LOCATES SYNC BIT SHIFTS
RESTACK (BIT/SEP304)
USES BIT/SEP304 TO CORRECT ERRORS. DELETES SYNC BITS.
DRUM SEP304 - STACK
STAKBLAST
CORRECTED BIT DUMP
RBUPS
LIST OF RANGE, BEARING UPDATES
FIXUP
DELETES ERRONEOUS RANGE DOWN PULSE
DRUM SEP304 - STACK (NEW VERSION)
DRUM SEP304 - ROWFS
ROWF
RANGE - ONLY WANDER FACTORS


NAVTAPE
TAPE SEPNO2
COPY OF FINAL VERSION OF SEP304-STACK
COUNTER
PRINT TOTAL LEFT, RIGHT ODOMETER CTS.
VELAN
PRINT AVERAGE VELOCITY PER 6.48 SEC
ARROW
DELETES ODOMETER PULSES DURING TURN AT EP-4 DEPLOYMENT
DRUM SEP304-ARROW
ARROW ROWFS
ROWF
RANGE-ONLY WANDER FACTORS (EP4 REMOVED)
CORRECTED RATIO DISTANCE TRAVELLED PER 100 m. RANGE CHANGE
RANGER
CALCULATES RANGE ARRAY (AVERAGED BETWEEN BOTH ODOMETERS) FOR EACH DATA ARRAY
ARROW-RANGES
NAV DATA ARRAYS READY FOR MERGING WITH SCIENCE (V80) DATA ARRAYS.

APPENDIX

NAVIGATION DATA PROGRAMS
+
INPUT/OUTPUT ROUTINES

```
SUBROUTINE PREAD(UNIT,BUF,L,$,*,*)
C       PREAD C OED VIA MTRAN
        INTEGER UNIT,REQLEN(20)/20*0/,STATUS(20)/20*2/,PARITY(20)/20*1/,
     .          BUF(1),STAT,FIRST(20)/20*1/
        LOGICAL START,LOOP,FIRST(20)/20*.TRUE./

C       SET FLAG FOR STARTING NEXT READ
        START=.TRUE.
        GO TO 1

C       ENTRY TO WAIT FOR END OF LAST PREAD REQUEST
        ENTRY PWAIT(UNIT,$,*,*)

C       SET FLAG FOR NOT STARTING NEXT READ
        START=.FALSE.

C       POST-ENTRY HOUSEKEEPING
    1   LOOP=.FALSE.
        IF(FIRST(UNIT))PRINT(6,50)UNIT,PARITY(UNIT)
   50   FORMAT(' UNIT',I3,' IS SET TO PARITY',I2)
        FIRST(UNIT)=.FALSE.

C       TEST STATUS OF LAST PREAD REQUEST
    2   STAT=STATUS(UNIT)
        IF(STAT)2,3,3

C       OPERATION COMPLETE - CHECK LENGTH
    3   IF(STAT.NE.REQLEN(UNIT))GO TO 4

C       IF ENTERED BY PWAIT, RETURN
        IF(.NOT.START)RETURN

C       ENTERED BY PREAD - START NEW INPUT
        REQLEN(UNIT)=L
        CALL MTRAN(UNIT,2,L,BUF,STATUS(UNIT))
        RETURN

C       WRONG LENGTH RECORD - PRINT MESSAGE
    4   PRINT(6,60)UNIT,REQLEN(UNIT),STAT
   60   FORMAT(' SHORT RECORD ON UNIT',I3/
     .         ' REQUESTED LENGTH =',I5/
     .         ' ACTUAL LENGTH =',I5)

C       RESET INDICATORS AND RETURN
        CALL RESET

        IF(START)RETURN 4
        RETURN *

C       LAST PREAD REQUEST INCOMPLETE OR IN ERROR
    5   STAT=-STAT
        GO TO(5,6,7,7),STAT

C       INCOMPLETE - WAIT FOR COMPLETION
    6   IF(LOOP)GO TO 16
        LOOP=.TRUE.
        CALL MTRAN(UNIT,22)
```

PREAD IS A TAPE/DRUM ASYNCHRONOUS INPUT ROUTINE.

4-3(1)

Digital Processing

1) Navigation Data

R.D. Watts

```
      C
      C     END OF FILE - WRITE MESSAGE AND RETURN
            WRITE(6,401)UNIT
  401   FORMAT(' END OF FILE ON UNIT',I3)
      C     UPDATE FILE POINTER
            FILE(UNIT)=FILE(UNIT)+1
            CALL RESET
            IF(START)RETURN 4
            RETURN 3
      C
      C     INPUT ERROR
            WRITE(6,402)UNIT,STATUS(UNIT)
  402   FORMAT(' DEVICE ERROR/OPERATION ABORTED ON UNIT',
     .       I3,' STATUS=',I2)
            CALL RESET
            IF(START)RETURN 5
            RETURN 3
      C
      C     LOOPING ERROR ON NTRAN WAIT
   15       WRITE(6,404)UNIT
  404   FORMAT(' NTRAN WAIT LOOP ON UNIT',I3)
            CALL RESET
            IF(START)RETURN 5
            RETURN 3
C
C
C
C
      C     ENTRY TO ASSIGN A UNIT
            ENTRY ASSIGN(INT,EXT)
            INTEGER EXT
            INTEGER EXTC(2)
      C
      C     ENTRY TO SET UNIT PARITY
            ENTRY PARITY(UNIT,IPAR)
            WRITE(6,405)UNIT,IPAR
  405   FORMAT(' UNIT',I3,' PARITY SET TO',I2)
            FIRST(UNIT)=.FALSE.
            PARITY(UNIT)=IPAR
            JPAR=IPAR+1
            GO TO (8,9),JPAR
    8       CALL NTRAN(UNIT,15,22)
            RETURN
    9       CALL NTRAN(UNIT,14,22)
            RETURN
C
C
C
C
      C     ENTRY TO POSITION INPUT TAPE
```

```
      ENTRY T_POS(UNIT,IFILE)

C     CHECK FOR COMPLETION OF EARLIER OPERATIONS
      CALL MTSAN(UNIT,22)
      STAT=STATUS(UNIT)
      IF(STAT)11,11,1
    1 STAT=-STAT
      GO TO (11,12,11,11),STAT
   12 FILE(UNIT)=FILE(UNIT)+1
   11 CALL RESET

C     POSITION TAPE
      MOVE=IFILE-FILE(UNIT)
      IF(MOVE)13,13,14
   14 CALL MTSAN(UNIT,8,MOVE)
      RETURN
   13 MOVE=MOVE-1
      CALL MTSAN(UNIT,8,MOVE)
      IF(IFILE.GT.1)CALL MTSAN(UNIT,8,1)
      FILE(UNIT)=IFILE
      RETURN


      ENTRY WRNDER(UNIT)
C     WRITES UNIT
      WRITE(6,600)UNIT
  600 FORMAT(' WRITE ISSUED TO UNIT',I3)
      CALL MTSAN(UNIT,22,17)
      FILE(UNIT)=1
      RETURN


C     END OF FILE MARK WRITER
      ENTRY EOFEND(UNIT)
      CALL MTSAN(UNIT,9)
      WRITE(6,603)UNIT
  603 FORMAT(' EOF WRITTEN ON UNIT',I3)
      FILE(UNIT)=FILE(UNIT)+1
      RETURN


      SUBROUTINE RESET
C     RESETS STATUS
      CALL MTSAN(UNIT,22)
      STATUS(UNIT)=0
      RESLEN(UNIT)=0
      RETURN


      END
$S SET TO,PTT/SLOW/,,FINDEROPS,,STACKBLAST,,PRRITE
```

PWRITE 1/2

ASYNCHRONOUS OUTPUT ROUTINE.

```
ARONY*CEPLIB,P 2111
   1              SUBROUTINE PWRITE(UNIT,BUF,LEN,$,$)
   2              INTEGER UNIT,BUF(1),LEN(20)/20*0/,STAT(20)/20*0/,
   3             .     PARITY(20)/20*1/,STATUS
   4              LOGICAL LOOP,START,FIRST(20)/20*.TRUE./
   5
   6        C     SETUP TO START NEXT WRITE OPERATION
   7              START=.TRUE.
   8              GO TO 1
   9
  10        C     ENTRY FOR WAITING FOR COMPLETION OF EARLIER WRITE
  11              ENTRY PWAIT(UNIT,$,$)
  12              START=.FALSE.
  13
  14        C     POST-ENTRY HOUSEKEEPING
  15            1 LOOP=.FALSE.
  16              IF(FIRST(UNIT))PRINT(6,600)UNIT,PARITY(UNIT)
  17          600 FORMAT(' UNIT',I3,' IS SET TO PARITY',,2)
  18              FIRST(UNIT)=.FALSE.
  19
  20        C     CHECK STATUS OF EARLIER OPERATIONS
  21            2 STATUS=STAT(UNIT)
  22              IF(STATUS)3,4,5
  23
  24        C     OPERATION HAS BEEN COMPLETED - START NEXT WRITE
  25            4 IF(.NOT.START)RETURN
  26              LEN(UNIT)=1
  27              CALL NTRAN(UNIT,1,LEN(UNIT),BUF,STAT(UNIT))
  28              RETURN
  29
  30        C     OPERATION INCOMPLETE OR IN ERROR - CHECK STATUS
  31            3 STATUS=-STATUS
  32              GO TO (7,7,8),STATUS
  33
  34        C     INCOMPLETE TRANSMISSION - NTRAN WAIT
  35            6 IF(.NOT.LOOP)GO TO 9
  36              WRITE(6,601)UNIT
  37          601 FORMAT(' NTRAN WAIT LOOP ON UNIT',I3)
  38              CALL RESET
  39              IF(START)RETURN 5
  40              RETURN 2
  41            9 LOOP=.TRUE.
  42              CALL NTRAN(UNIT,22)
  43              GO TO 2
  44
```

```
C       END OF OUTPUT SPACE DETECTED
    7   WRITE(A,602)UNIT
  602   FORMAT(' END OF OUTPUT SPACE ON UNIT',I3)
        CALL RESET
        IF(START)RETURN 4
        RETURN 3

C       ERROR ON LAST WRITE
    8   WRITE(A,603)UNIT,STATUS
  603   FORMAT(' WRITE ERROR ON UNIT',I3,' STATUS =',I2)
        CALL RESET
        IF(START)RETURN 5
        RETURN 3

C       PREVIOUS WRITE COMPLETE  -  CHECK LENGTH
    5   IF(STATUS.NE.RLEN(UNIT))GO TO 10

        GO TO 4

C       LENGTH ERROR
   10   WRITE(A,604)UNIT,RLEN(UNIT),STATUS
  604   FORMAT(' OUTPUT ERROR ON UNIT',I3/
     .       ' WORDS REQUESTED',I6/' WORDS TRANSMITTED',I5)
        CALL RESET
        IF(START)RETURN 5
        RETURN 3

C       ENTRY TO SET TAPE PARITY
        ENTRY PUPAR(UNIT,IPAR)
        FIRST(UNIT)=.FALSE.
        WRITE(A,605)UNIT,IPAR
  605   FORMAT(' UNIT',I3,' PARITY SET TO ',I2)
        PARITY(UNIT)=IPAR
        JPAR=IPAR+1
        GO TO (11,12),JPAR
   11   CALL NTRAN(UNIT,15,22)
        RETURN
   12   CALL NTRAN(UNIT,14,22)
        RETURN

C       SUBROUTINE TO RESET STATUS INDICATORS
        SUBROUTINE RESET
        RLEN(UNIT)=0
        STAT(UNIT)=0
        RETURN

        END
```

RDWAIT

```
[illegible],RDWAIT
      SUBROUTINE RDWAIT(UNIT,BUF,L,S,*,*)
      INTEGER UNIT,BUF(L)
      CALL RDBEGIN(UNIT,BUF,L,S1,S2,S3)
      CALL RDATT(UNIT,S1,S2,S3)
      RETURN
    1 RETURN 1
    2 RETURN 2
    3 RETURN 3
      END
```

WRWAIT

```
[illegible],WRWAIT
      SUBROUTINE WRWAIT(UNIT,BUF,L,*,*)
      INTEGER UNIT,BUF(L)
      CALL WRITE(UNIT,BUF,L,S1,S2)
      CALL RDATT(UNIT,S1,S2)
      RETURN
    1 RETURN 1
    2 RETURN 2
      END
```

RDWAIT AND WRWAIT ARE SYNCHRONOUS INPUT AND OUTPUT ROUTINES WHICH USE THE ASYNCHRONOUS ROUTINES RREAD AND RWRITE, RESPECTIVELY.

NAVSTRIP

```
,ARRAY*,SPLIT,NAVSTRIP
      C     NAVSTR
      C     STRIPS NAV DATA ERRORS EACH RECORD, WITH CHECKING
            REAL BUF(413)
            INTEGER IN/2/,OUT/2/,OUTREC
            COL(X)=100*FLD(18,5,X)+10*FLD(24,5,X)+FLD(30,5,X)

      C     START COUNTER
            INREC=0
            OUTREC=0

      C     READ A RECORD
    3       CALL RD ATT(IN,BUF,413,$1,$2,$3)
            INREC=INREC+1

      C     CHECK IT
            IF(COL(BUF(413)).GT.195160) GO TO 5
            CALL WR ATT(OUT,BUF(381),33,$2,$3)
            OUTREC=OUTREC+1




            GO TO 3
    4       WRITE(6,401)INREC
  401   FORMAT(' ERRORS IN INPUT RECORD',I4)
            GO TO 3
    2       STOP

      C     END OF DATA
    1       CALL FILEND(OUT)
            WRITE(6,601)OUTREC
  601   FORMAT(I4,' RECORDS OUTPUT')
            STOP

    5       K=COL(BUF(413))
            WRITE(6,602)K
  602   FORMAT(I4,' NAV UPDATES')
            GO TO 4
            END
```

REFORM

```
,6RDWX*SEPLIB,REFORM
    1        C       REFORM
    2        C       BLOCKS OF DATA INTO 112-WORD BLOCKS
    3        C       REVERSES BIT ORDER IN EACH CHARACTER
    4                INTEGER IN/3/,OUT/2/,BUF(33),BLOCK(112)
    5                UPS(X)=1000*FLD(18,6,X)+100*FLD(24,6,X)+FLD(30,6,X)
    6        C
    7                CALL RD-ATT(3,BUF,33,$11,$11,$11)
    8                CALL RD-ATT(3,BUF,33,$11,$11,$11)
    9                WRITE(7,602)
   10          602 FORMAT(' INPUT NO. OF RECORDS')
   11                READ(5,500)NREC
   12          500 FORMAT(I3)
   13                WRITE(7,603)NREC
   14          603 FORMAT(I4)
   15        C
   16        C       SET TO START OF OUTPUT BLOCK
   17                JCHAR=1
   18        C
   19        C       PROCESS BY OUTPUT PAGE
   20                DO 1 IPAGE=1,NREC,50
   21                ISTART=IPAGE
   22                IEND=ISTART+49
   23        C
   24        C       PRINT TITLES
   25                WRITE(7,600)
   26          600 FORMAT('1RECORD',5X,'NO. OF UPDATES',5X,
   27               .      'START OUTPUT CHAR')
   28        C
   29        C       PROCESS RECORDS
   30                DO 2 IREC=ISTART,IEND
   31        C
   32        C       INPUT RECORD
   33                CALL RD ATT(IN,BUF,33,$10,$11,$11)
   34        C
   35        C       DECODE UPDATA COUNT
   36                NUPS=UPS(BUF(33))
   37        C
   38        C       PRINT STATS
   39                WRITE(7,601)IREC,NUPS,JCHAR
   40          601 FORMAT(1A,I14,T39,I3)
   41        C
   42        C       START MOVING CHARS
   43                IUP=1
   44        C
```

```
      C       MOVE CHARS
    4 IWD=(IUP-1)/6+1
      IBIT=6*(MOD(IUP-1,6)-1
      IWD=(JCHAR-1)/6+1
      IBIT=6*(MOD(JCHAR-1,7)+6
      DO 3 I=1,6
    3 ELD(ABS(JBIT-I),1,BLOCK(JWD))=ELD(ABS(IBIT+I),
     .      1,BUF(IWD))
      C
      C       NEXT CHAR
      JCHAR=JCHAR+1
      IF(JCHAR-67215,5,6
    5 IUP=IUP+1
      IF(IUP-IUPS)4,4,2
    6 CALL WRITEOUT,BLOCK,112,*11,*11)
      JCHAR=1
      GO TO 5
      C
    2 CONTINUE
    1 CONTINUE
      C
      C       EMPTY LAST OUTPUT BLOCK
   10 CALL WRITEOUT,BLOCK,112,*11,*11)
      CALL FILEND(OUT)
   11 STOP
      C
      END
```

RAWBIT

```
U3AA20:[*.CCPL]*.*;*RBIT
      1               INTEGER FUNCTION RAWBIT(I,*)
      2       C       FETCHES SPECIFIED RAW BIT FROM DATA FILE
      3               INTEGER BLOCK/1/,DATA(1111),IN/3/
      4
      5               NBLOCK=(I-1)/8192+1
      6               IF(NBLOCK.EQ.BLOCK)GO TO 1
      7               IF(NBLOCK.LT.BLOCK)GO TO 2
      8                 READ(4,5001)I,NBLOCK,BLOCK
      9           5001 FORMAT(' ILLEGAL BLOCK SPECIFICATION',3I5)

     10                 STOP
     11               CALL GO_TO_BLOCK(4,DATA,112,BLOCK,512,5100)
     12               BLOCK=BLOCK+1
     13
     14       C       LOOKUP SECTION
     15             I=MOD(I-1,8192)
     16               IWD=I/32+1
     17               INIT=ABS(IAND(I,31))
     18               BASBIT=LOC(DATA,I,DATA(IWD))
     19               RETURN
     20
     21       C       END OF DATA RETRIEVAL
     22             IF RETURN 2
     23
     24               END
```

BITBLAST

```
AARDWX:CFB[10,0]BITBLAST
    1         C       BITBLAST
    2         C       DUMPS BITS IN A RAD FORMAT USING RADBIT
    3                 INTEGER LINE(120),IN/3/,OUT,RADBIT
    4
    5         C       SET PARTITION
    6                 CALL PP ANSIN,11
    7
    8         C       READ OUTPUT UNIT
    9                 READ(5,*)IOUT
   10           1    FORMAT(I)
   11
   12         C       READ LINE LENGTH
   13                 READ(5,*)LONG
   14           2    FORMAT(I3)
   15
   16         C       SET TIME AND BIT COUNTERS
   17                 ITIME=LONG
   18                 IBIT=0
   19
   20         C       START NEW PAGE
   21              4  WRITE(OUT,A001)
   22           A001  FORMAT(*1*,8X,*TIME*///)
   23
   24                 DO 2 ILINE=1,50
   25                 ITIME=ITIME+LONG
   26                 TIME=.0125*ITIME
   27
   28         C       SCAN THE LINE
   29                 DO 3 ISCAN=1,LONG
   30                 IBIT=IBIT+1
   31              3  LINE(ISCAN)=RADBIT(IBIT,SW)
   32
   33         C       PRINT THE LINE
   34              2  WRITE(OUT,A001)ITIME,TIME,(LINE(I),I=1,LONG)




   35           A001  FORMAT(2F9.3,  ,120(1X,I1))
   36
   37         C       START NEW PAGE
   38                 GO TO 1
   39
   40         C       END OF CARDS
   41              6  ISCAN=ISCAN-1
   42                 WRITE(OUT,A001)ITIME,TIME,(LINE(I),I=1,ISCAN)
   43
   44                 STOP
   45                 END
AARDWX:CFB[10,0]STACK
```

FINDERRORS

```
.RUN*SFPLUS,FINDERRORS
      C       FINDERRORS
      C       LOCATES AND PRINTS ERRONEOUS REGIONS OF NAVIGATION DATA
            INTEGER RAMBIT,SYNC,LINE(42,2),LINE*(17,10LD/2/
      C       POINT FIRST LINE
            IBIT=1
            CALL FIL
            CALL IOMPR(LINEP,IBIT)
      C       READ SYNC POSITION
          4 WRITE(6,400)
        400 FORMAT(' SYNC=')
            READ(5,*,ERR=4)SYNC
        500 FORMAT(I)
      C       SCAN THE LINE
          3 DO 1 I=SYNC,42,2
            IF(LINE(I,LINE*(12,2,1
          1 CONTINUE
      C       NEXT LINE
            IBIT=IBIT+42
            CALL FIL
            GO TO 3
      C       ERROR FOUND - PRINT THE LINE
          2 CALL IOMPR(OLD,IBIT=42)
            CALL IOMPR(LINE*,IBIT)
      C       NEXT LINE
            IBIT=IBIT+42
            CALL FIL
            GO TO 4

            SUBROUTINE FIL
            IBIT=IBIT-1
            LINE*=LINE*
            OLD=3=OLD
            DO 1 J=1,42
          1 LINE(J,LINE*(1=BARBIT(IBIT+J,*2)
            RETURN
          2 STOP

            SUBROUTINE LINEP(I,IBIT)
            TIME=.0125*(IBIT-1)
            WRITE(6,400)IBIT,TIME,(LINE(J,1),J=1,*-1)
        400 FORMAT(17,F9.3,2X,16(1X,I1))
            RETURN

            END
```

RESTACK

```
      C       RESTACK
      C       REFORMATS CORRECTED RAW DATA ELIMINATES SYNC PULSES
            INTEGER BLOCK(112,2),BIT,OUT/2/,LAST,
     *
      C       READ MAXIMUM BIT NO.
            WRITE(A,600)
  600   FORMAT(' MAX BIT NO.')
            READ(5,601)LAST
  601   FORMAT(I4)
            IBIT=0
      C       FILL A BLOCK
            DO 1 IBIT=1,LAST,112
            DO 2 IWORD=1,112
            DO 2 IC.AR=7,35,4
            IBIT=IBIT+1
            MBUNNY=BIT(IBIT,$20)
  30    CONTINUE
            DO 2 KBIT=7,0,-1
            IBIT=IBIT+1
            K=ANDS(ICHAR,KBIT)
            BLOCK(IWORD,1)=BIT(IBIT,K)
  2
            GO TO 3
  1         BLOCK(IWORD,1)=0
  4         CONTINUE
  3
      C       WRITE TAP BLOCK
            CALL PWRITE(OUT,BLOCK(1),IBUF(1),112,$4,$4)
          1 IBUF(1)=IBUF
            CALL PWAIT(OUT,$4,$4)
      C       PRINT FINAL STATS
            K=IBIT/4//8192
            WRITE(A,611)IBIT,K
  611   FORMAT(//,' BITS WRITTEN=',I,' BLOCKS WRITTEN=',
     *  STOP
            END
LNK,S SEQIO,MAINTAPE,,CALIBOUT,,VELAN,,STRAIGHTEN,,TERMINAL
```

BIT / SEP304

```
ARP:X*:EPL:P,P:T/SEP3[*
  1                INTEGER FUNCTION BIT(I,S)
  2          C     CORRECT BITS FROM SEP304
  3                INTEGER BLOCK/1/,SHIFT/1/,TEST(16)/29*,2472,5262,
  4               .     67284,"6984B,25B876,243233,275236,
  5               .     27/794,281C24,283434,283B81,28/4B ,
  6               .     28/941,28/691,2841D0/BRANCH(16)/1,2,2*1,
  7               .     2,1,6*2,1,2,2,3/TESTER/24 H/RA BIT
  8                LOGICAL DONE/.FALSE./
  9                IF(DONE)RETURN 3
 10
 11                I=I+SHIFT
 12                BIT=RAW(I,S)
 13
 14                IF(I.LT.TESTER)RETURN
 15
 16                BLOCK=BLOCK+1
 17                TESTER=TEST(BLOCK)
 18                K=BRANCH(BLOCK-1)
 19                GO TO (1,2,3),K
 20
 21              1 SHIFT=SHIFT-1
 22                RETURN
 23
 24              2 BIT=1
 25                RETURN
 26
 27              3 DONE=.TRUE.
 28                RETURN 2
 29
 30                END
```

STACKBLAST

```
ANDREW*FSOLIS,*STACKBLAST
      1       C       STACKBLAST
      2       C       DUMPS BITS IN A SYNC-BIT-DEFINED FORMAT USING PARITY
      3               INTEGER LINE(132),IN/3/,OUT,PARITY
      4
      5       C       SET PARITIES
      6               CALL SPARAM(IN,1)
      7
      8       C       READ OUTPUT UNIT,LINE LENGTH, MAX TIME
      9               READ(5,*)OUT,LONG,TMAX
     10           1  FORMAT(I1/I1/F10.2)
     11
     12       C       GET TIME AND BIT COUNTERS
     13               MONC=(7-(LONG))/8
     14               TIME=-LONG
     15               JBIT=0
     16
     17       C       START NEW PAGE
     18           2   WRITE(OUT,100)
     19         100 FORMAT(1   BIT',4X,'TIME'//)
     20
     21               DO 3 ITIME=1,50
     22               TIME=TIME+MONC
     23               TIME=.01*125*TIME
     24
     25       C       SCAN THE LINE
     26               DO 3 ISCAN=1,LONG
     27               JBIT=JBIT+1
     28           3   LINE(ISCAN)=PARITY(LINE,JBIT,*4)
     29
     30       C       PRINT THE LINE
     31               WRITE(OUT,101)TIME,(LINE(I),I=1,LONG)
     32         101 FORMAT(1X,F9.3,2X,15(1X,A1))
     33       C       STOP IF TIME EXCEEDED
     34               IF(TIME.GE.TMAX)STOP
     35           3   CONTINUE
     36
     37       C       START NEW PAGE
     38               GO TO 1
     39
     40       C       END OR ERROR
     41           4   ISCAN=ISCAN-1
     42               WRITE(OUT,101)TIME,(LINE(I),I=1,ISCAN)
     43
     44               STOP
     45
     46               END
```

RBUPS 1/2

```
,RD*X*SEQ[1:6,P:UPS
  1         C       RBUPS
  2         C       LOCATES RANGE AND BEARING UPDATES
  3                 INTEGER RUP,RDOWN,RUP,RDOWN,BEAM,ODOI,ODOR,
  4                .      PA,NIT,PP,2M,RD,RM,MI,PR
  5
  6         C       READ MAX TIME IN MINUTES
  7                 READ(5,*)TIME
  8           1 FORMAT(I10.0)
  9         C       CONVERT TO SECONDS
 10                 TIME=60.*TIME
 11         C       CONVERT TO FRAME NUMBER
 12                 NFRAME=TIME/.0774/5
 13         C       READ FRAME COUNT OFFSET
 14                 READ(5,*)IOFF
 15           2 FORMAT(I3)
 16
 17         C       SET READ UNIT PARITY
 18                 CALL PRTAP(3,1)
 19
 20         C       PRINT MAXIMUM FRAME NUMBER, PAGE TITLES
 21                 WRITE(6,100)NFRAME
 22         100 FORMAT(1/,' FRAMES WILL BE PROCESSED')
 23                 WRITE(6,101)
 24         101 FORMAT(' FRAME',T13,'TIME',T20,'UPDATE',T29,'R+',
 25                .      T39,'R-',T49,'D+',T58,'R-',T68,'ANGE',
 26                .      T5F,'BEARING',T74,'RE ODO',T72,'  ODO'/)
 27                 ITME=1
 28
 29         C       COUNT A FRAME
 30                 DO 1 IFRAME=1,NFRAME
 31                 IF(A*(IFRAME-1))
 32                 RP=RAND(T(I+1,$0)
 33                 RM=RAND(T(I+2,$0)
 34                 DP=RAND(T(I+3,$0)
 35                 DM=RAND(T(I+4,$0)
 36                 WP=RAND(T(I+5,$0)
 37                 WM=RAND(T(I+6,$0)
 38
 39         C       UPDATE THE COUNTS
 40                 RUP=RUP+RP
 41                 RUP=RUP+RP
 42                 RDOWN=RDOWN+RM
 43                 RDOWN=RDOWN+RM
 44                 ODOI=ODOI+WI
 45                 ODOR=ODOR+WM
 46                 ------------
```

2/2

```
      C       IF THE  ANGLE/BEARING HAS CHANGED, DO A PRINT
              IF(RP+RM+HP+BM.EQ.0)GO TO 1
              RANGE=(RUP-RDOWN)*.1
              BEAR=RUP-RDOWN
              JFRAME=IFRAME-NOFF
              TIME=JFRAME*.033333
              WRITE(6,602) JFRAME,TIME,RP,RM,BP,BM,WP,WM,RUP,
             .     RDOWN,RUP,RDOWN,RANGE,BEAR,QUAL,QUAL
          602 FORMAT(I7,F10.3,2X,A11,4I5,F6.1,I7,I10,I8)
              LINE=LINE+1
              IF(LINE.LE.50)GO TO 1
              LINE=1
              WRITE(6,601)
          601 CONTINUE
              STOP

      C       ERROR EXIT
          9   WRITE(6,603)IFRAME
          603 FORMAT(' AT FRAME',I6)
              STOP

              END
```

```
SCAN:21
EOF:21
0:P 50
*SDFF*
C       FIXUP
        INTEGER BUF(112)
        DO 1 IREC=1,12
        CALL RDWAIT(3,BUF,112,$9,$9,$9)
      1 CALL WRWAIT(2,BUF,112,$9,$9)
        IREC=12
        CALL RDWAIT(3,BUF,112,$9,$9,$9)
        WRITE(6,600)BUF(89)
    600 FORMAT(O13)
        FLD(7,1,BUF(89))=0
        WRITE(6,600)BUF(89)
        CALL WRWAIT(2,BUF,112,$9,$9)
        IREC=13
      2 CALL RDWAIT(3,BUF,112,$9,$9,$9)
        CALL WRWAIT(2,BUF,112,$9,$9)
        IREC=IREC+1
        GO TO 2
      9 WRITE(6,601)IREC
    601 FORMAT(I3,' RECORDS COPIED')
        STOP
        END
SCAN:20
EOF:21
0:
```

FIXUP

(DELETES ERRONEOUS R- PULSE FROM SEP304-STACK)

ROWF 1/2

```
ROWF.SEPLIB.DOM
  1        C       ROWF - RANGE ONLY WANDER FACTORS
  2        C       COMPUTES WANDER FACTORS ON BASIS OF RANGE AND CODE
  3                INTEGER RAWDTT,IROLD/0/,IRNEW,RENEW/0/,RENEW,
  4               .       RANGE/1/,RACC/0/,RP,RM,REO/0/,IRO/0/
  5
  6        C       READ MAX TIME (MINUTES)
  7                READ(5,*)IDUMAX
  8          100   FORMAT(F10.0)
  9                WRITE(6,600)IDUMAX
 10          600   FORMAT(1H1,' WANDER FACTOR DETERMINATION',/
 11               .       F10.3,' MINUTES OF DATA WILL BE PROCESSED')
 12        C       CONVERT MINUTES TO BIT TIMES
 13                IDMAX=IDMAX*60./.00125
 14
 15        C       SCAN THE DATA
 16                DO 1 IP=1,IDMAX,4
 17                RP=RAWDTT(IP,$10)
 18                RM=RAWDTT(IP+1,$10)
 19                REO=REO+RAWDTT(IP+4,$10)
 20                IRO=IRO+RAWDTT(IP+5,$10)
 21
 22        C       IF NO UPDATE, CONTINUE THE SCAN
 23                IF(RP-RM.EQ.0)GO TO 1
 24
 25        C       COMPUTE NEW RANGE AND TEST
 26                RACC=RACC+RP-RM
 27                IF(RANGE-RACC)4,3,1
 28
 29        C       SAVE VALUES
 30              3 LRNEW=LRO
 31                RENEW=REO
 32                IROLD=IP
 33                GO TO 1
 34
 35
 36              4 CALL PRTR
 37              1 CONTINUE
 38
```

```
      C       PRINT THE LAST POINT
              CALL PRTR
           10 STOP
              SUBROUTINE PRTR
      C       COMPUTE,PRINT, AND REORGANIZE
              RANGE=RANGE+1
              ROWERF=100./.49/(RENEW-REOLD)
              ROWELR=100./.49/(LRNEW-LROLD)
              DIST=.1*RANGE-.15
              IF(RANGE.GT.2)GO TO 1
              ROWERF=ROWERF/2.
              ROWELR=ROWELR/2.
            1 CONTINUE
              REOLD=RENEW
              LROLD=LRNEW
              RENEW=REO
              LRNEW=LRO
              WRITE(2,200)DIST,IROLD,ROWERF,ROWELR
          200 FORMAT(F5.2,I7,2F7.3)
              IROLD=IR
              RETURN
              END
```

NAVTAPE

```
$ROWX*SFPLTN,NAVTAPE
  1        C       NAVTAPE
  2        C       COPIES NAV FILE ONTO TAPE
  3                INTEGER IN/3/,OUT/7/,BLOCK(112,2),IBUF/1/
  4
  5
  6        C       READ NO. OF BLOCKS TO COPY
  7                WRITE(6,600)
  8          600   FORMAT(' NO. OF BLOCKS')
  9                READ(5,500)NBLOCK
 10          500   FORMAT(I4)



 11
 12        C       COPY
 13                CALL PREAD(IN,BLOCK,112,$3,$3,$3)
 14                DO 1 N=1,NBLOCK
 15                IBUF=3-IBUF
 16                CALL PREAD(IN,BLOCK(1,IBUF),112,$3,$3,$3)
 17              1 CALL PWRITE(OUT,BLOCK(1,3-IBUF),112,$3,$3)
 18                N=NBLOCK
 19              3 CALL PWAIT(OUT,$2,$2)
 20                CALL FILEND(OUT)
 21                WRITE(6,601)N
 22          601   FORMAT(I5,' BLOCKS WRITTEN')
 23              2 STOP
 24                END
```

```
C   COUNTER
    INTEGER ODOL/0/, ODOR/0/, RAWBIT
    DO 1 I = 1, 40762
    IBIT = 6*I - 1
    ODOR = ODOR + RAWBIT (IBIT, $2)
    ODOL = ODOL + RAWBIT (IBIT + 1, $2)
    IF (I.EQ. 31454 .OR. I .EQ. 40762) WRITE (6,600) ODOR, ODOL
600 FORMAT (2I6)
 1  CONTINUE
 2  STOP
    END
```

OUTPUT AT 2 STOPS:

9901 9991

13026 13167

VELAN

```
ANALYZE,FREE,14,VELAN
      C       VELAN
      C       ANALYZES VELOCITIES FROM SEL NAV DATA - BY RECORD
            INTEGER RECST,RECND,REC,BITST,BITND,BIT,RAWBIT
            REAL VL(4)/4*0./VR(4)/4*0./
            INTEGER ODDL,ODDR
            BITSTF(N)=(((N-13)*256)/72)*4+5DR3
            CALL PRGAR(3,1)
            DO 1 RECST=1,500,4
            IF(MOD(RECST,200).EQ.1)WRITE(4,600)
        600 FORMAT('1'//(' ',T8,4('VELOCITY',4X)//
           .      ' REC',4(' RIGHT  LEFT  ')/
           .      ' ')

            RECND=RECST+3
            J=0
            DO 2 REC=RECST,RECND
            BITST=BITSTF(REC)
            BITND=BITSTF(REC+1)-4
            ODDL=0
            ODDR=0
            DO 3 BIT=BITST,BITND,4
            IF(BIT.LT.0)GO TO 3
            ODDR=ODDR+RAWBIT(BIT+4,$4)
            ODDL=ODDL+RAWBIT(BIT+5,$4)
          3 CONTINUE
            J=J+1
            VL(J)=ODDL*.49/4.44*3.4
          2 VR(J)=ODDR*.49/4.44*3.4
          1 WRITE(4,601)RECST,(VR(J),VL(J),J=1,4)
        601 FORMAT(I4,4(2FA.2,2X))
          4 STOP


            END
```

ARROW

```
[illegible]
      C     ARRAY
      C     CONSTRUCT STRAIGHTENED NAV DATA BY SEARCHING FOR-0 THEN
            REAL *4 A(112)
            INTEGER STRAIT,BLOCK,ZERO,OUT
            J=1
            DO 1 BLOCK=1,54
            DO 2 NO 0=1,112
            DO 3 BIT=0,35
            OUT=ADDR(BIT)



            J=J+1
          1 FIND(IRT=,I,'AVE ORBIT=',IBUFF(I,54)
          2 CONTINUE
          3 CALL WD A(112,NAV,112,54,54)
            WRITE(6,600)
        600 FORMAT(' DONE')
            STOP


            INTEGER FUNCTION STRAIT(IBIT,*)
      C     STRAIGHTENS NAV DATA AT ZERO
            INTEGER BARBIT
            IBIT=IBIT-1777
            IF(IBIT)1,1,2
          1 STRAIT=
            RETURN
          2 STRAIT=ANDBIT(IBIT,3)
            IF(IBIT.LT.2002)RETURN
            IF(IBIT.GT.2124)RETURN
            STRAIT=
            RETURN
          3 RETURN 2
            END
```

RANGER

```
      C       RANGER
      C       COMPUTES RANGES FROM POWER FROM SERIAL-ACRON
              INTEGER PAT(32)/5,4,4,4,5,4,4,4,
             .                5,4,4,4,5,4,4,4,
             .                5,4,4,4,5,4,4,4,
             .                5,4,4,2,5,4,1,2/
             .      DEGT(4)/1,2,3,5,9,17/COUNTS(4)/4*0/
             .      BIT/0/START/1/BITA,RABIT
              REAL  RANGES(384,30),RANGEI/0./RANGER/0./RANGE
C       GET FIRST RANGE CORRECTION FACTORS
              CALL RCF(IBIT,RCFR,RCFI)
C       FOR EACH RECORD
              DO 1 IREC=1,384
C       FOR EACH FRAME
              DO 2 IFRAME=1,32
              IFREQ=PAT(IFRAME)
C       ADD THE BITS
              BIT=BIT+IB
              BITA=(BIT/2)*4
              DO 3 IBIT=START,BITA,4
              RANGEI=RANGEI+RCFI*DAWRIT(IBIT+5,54)
              RANGER=RANGER+RCFR*DAWRIT(IBIT+4,54)
              IF(IBIT.EQ.IBITICALL RCF(IBIT,RCFR,RCFI)
            3 CONTINUE
              START=BITA+1
C       STORE THE RANGE
              IF(IFREQ)2,2,4
            4 COUNTS(IFREQ)=COUNTS(IFREQ)+1
              IDEST=DEST(IFREQ)
              RANGE=(RANGEI+RANGER)/2.
              CALL STORE(RANGES(1,IDEST),COUNTS(IFREQ))
            2 CONTINUE
            1 CONTINUE
C       WRITE THE RANGE ARRAY
              WRITE(4)RANGES

            9 STOP


              SUBROUTINE STORE(A,I)
              REAL  A(1)
              A(I)=RANGE
              RETURN


              SUBROUTINE RCF(IBIT,RCFR,RCFI)
              READ(2,200)IBIT,RCFR,RCFI
          200 FORMAT(I4,I2,2F7.3)
              RCFI=RCFI*.49
              RCFR=RCFR*.49
              WRITE(4,400)RANGER,RANGEI
          400 FORMAT(2F7.1)
              RETURN

              END
```

VELAN
FROM
SEP304 - ARR0

VELOCITIES
KM/HR

REC	VELOCITY RIGHT	VELOCITY LEFT	VELOCITY RIGHT	VELOCITY LEFT	VELOCITY RIGHT	VELOCITY LEFT	VELOCITY RIGHT	VELOCITY LEFT
1	.00	.00	.00	.00	.00	.00	.54	.00
5	.54	.27	.54	.27	1.91	1.63	2.72	2.72
9	3.54	3.27	3.27	3.27	3.54	3.54	4.08	3.81
13	4.90	4.90	5.44	5.72	8.71	8.71	9.26	8.98
17	9.26	8.98	8.71	8.98	9.53	9.53	10.07	9.53
21	10.07	10.07	10.34	10.34	9.53	10.07	9.80	8.98
25	10.62	10.62	9.53	9.80	10.89	10.34	10.89	10.62
29	11.16	11.16	9.53	10.34	8.98	9.26	9.53	9.26
33	8.98	7.89	7.62	7.89	8.71	8.44	6.81	8.17
37	8.98	8.71	8.17	8.44	8.17	7.62	8.98	8.17
41	8.17	8.71	9.80	9.80	10.07	10.07	9.26	8.98
45	4.36	3.81	2.18	2.18	3.27	3.81	.82	.54
49	1.63	2.18	.27	.00	.00	.00	.00	.00
53	.00	.00	.00	.00	.00	.00	.00	.00
57	.00	.00	.00	.00	.00	.00	.00	.00
61	.00	.00	.00	.00	.00	.00	.00	.00
65	.00	.00	.00	.00	.00	.00	.00	.00
69	.00	.00	.00	.00	.00	.00	.00	.00
73	.00	.00	.00	.00	.00	.00	.00	.00
77	.00	.00	.00	.00	.00	.00	.00	.00
81	.00	.00	3.54	2.99	4.90	6.26	6.81	7.08
85	9.26	8.98	7.62	7.08	9.53	9.53	11.43	11.16
89	8.98	8.44	8.44	8.98	9.53	9.80	9.80	10.34
93	10.34	10.62	11.16	10.89	8.44	8.98	10.07	10.34
97	8.98	9.53	8.71	7.89	9.26	8.98	8.71	9.26
101	9.53	9.80	9.26	9.26	8.17	9.26	8.98	8.98
105	9.26	9.80	9.80	10.07	9.80	10.07	9.26	9.53
109	9.26	9.53	10.34	10.34	10.62	10.62	7.62	8.17
113	6.53	7.08	9.53	8.71	8.98	8.98	10.07	10.62
117	8.17	8.44	7.89	7.08	8.17	8.44	8.71	8.71
121	8.71	8.71	8.98	9.26	9.53	9.80	10.34	10.62
125	9.80	9.80	9.53	9.80	10.07	10.34	10.34	9.80
129	10.07	10.34	10.62	11.16	9.53	10.34	8.71	7.62
133	5.44	5.17	6.53	6.81	7.89	7.62	8.44	8.71
137	9.80	10.07	9.26	9.53	9.53	8.98	8.71	8.71
141	10.07	10.34	9.53	9.80	9.80	9.80	11.43	11.16
145	12.25	12.25	11.71	11.16	10.62	10.07	10.62	11.43
149	11.16	11.43	11.16	10.89	10.89	10.62	11.16	11.16
153	11.98	11.43	9.26	10.07	10.34	10.89	9.80	10.34
157	9.80	9.80	8.17	8.71	8.98	9.26	7.62	7.89
161	10.34	10.07	9.80	8.98	10.07	10.07	10.07	9.80
165	9.80	10.07	8.44	8.17	6.53	7.62	7.62	7.08
169	7.08	6.81	7.35	7.08	7.62	7.08	7.62	8.17
173	7.35	7.08	8.98	8.98	9.53	10.34	10.07	9.80
177	9.80	9.53	9.53	9.53	9.26	10.07	8.71	8.98
181	10.07	10.07	10.62	11.16	11.43	11.43	9.80	9.80
185	10.89	11.43	10.07	10.07	8.71	8.44	8.17	8.17
189	8.17	8.44	8.98	9.53	10.34	10.34	10.34	10.62
193	8.44	8.71	10.34	10.07	10.34	10.07	10.34	10.62
197	9.53	10.89	7.08	7.08	10.34	10.34	10.62	10.34

REC	VELOCITY RIGHT	VELOCITY LEFT	VELOCITY RIGHT	VELOCITY LEFT	VELOCITY RIGHT	VELOCITY LEFT	VELOCITY RIGHT	VELOCITY LEFT
201	9.26	8.71	8.17	7.89	9.26	9.80	11.16	11.43
205	9.80	10.62	7.62	7.62	8.98	8.98	6.26	6.26
209	8.44	7.89	9.26	10.07	11.43	11.71	11.43	11.71
213	10.62	10.89	10.34	10.34	9.26	9.53	9.26	9.26
217	8.71	9.26	9.80	10.07	9.26	9.53	8.17	8.17
221	4.63	4.08	2.99	3.54	1.91	2.18	.00	.00
225	.00	.00	.00	.00	.00	.00	.00	.00
229	.00	.00	.00	.00	.00	.00	.00	.00
233	.00	.00	.00	.00	.00	.00	.00	.00
237	.00	.00	.54	.54	4.36	3.81	7.89	6.81
241	8.44	8.71	9.80	9.53	9.26	9.53	9.26	8.98
245	9.26	8.71	10.34	10.89	10.34	10.89	11.71	11.71
249	10.62	10.62	10.34	10.89	8.26	9.08	8.08	8.35
257	7.08	7.08	6.81	6.53	7.08	7.62	8.71	9.80
261	9.53	9.53	9.80	8.71	9.53	8.71	9.80	9.80
265	7.89	7.89	8.71	9.53	9.80	9.53	9.80	10.34
269	9.53	9.53	10.62	10.89	10.07	10.34	8.71	8.98
273	9.26	8.98	7.89	8.44	7.89	7.89	9.53	8.98
277	10.34	10.34	8.44	8.17	9.80	10.34	10.62	10.89
281	11.43	11.16	11.71	12.25	11.71	11.98	12.25	11.98
285	11.43	11.71	11.16	11.43	11.71	11.98	11.16	11.43
289	11.43	11.43	11.43	11.71	12.25	11.98	11.71	11.98
293	10.62	10.34	10.07	10.34	11.16	11.43	10.62	10.89
297	8.98	8.98	1.36	1.36	4.36	2.72	4.63	4.63
301	6.81	7.62	7.08	7.89	8.17	7.62	8.98	8.44
305	10.62	11.16	10.89	11.16	10.62	10.89	5.99	6.53
309	7.35	6.81	8.98	8.71	5.72	5.99	7.08	7.08
313	9.53	9.80	10.07	10.07	8.17	8.17	8.98	8.98
317	10.07	9.53	6.81	7.08	5.17	5.72	3.81	3.81
321	4.08	3.54	2.45	2.99	.27	.27	.00	.00
325	.00	.00	.00	.00	.00	.00	.00	.00
329	.00	.00	.00	.00	.00	.00	.00	.00
333	.00	.00	.00	.00	.00	.00	1.36	1.36
337	4.90	4.63	7.08	6.81	7.08	7.35	7.08	7.08
341	6.81	6.81	7.89	7.89	7.62	7.62	7.35	7.62
345	8.17	8.17	9.80	9.80	10.34	10.34	7.08	7.08
349	8.99	8.44	8.26	8.80	8.98	9.26	8.62	8.89
357	8.71	8.71	9.53	9.53	7.62	7.89	8.17	7.35
361	6.53	5.99	8.17	8.44	9.26	9.26	7.62	7.89
365	8.17	8.44	9.26	10.34	11.71	11.71	11.43	11.43
369	8.71	9.26	8.17	8.17	10.07	9.80	8.98	9.53
373	8.17	7.89	5.99	6.26	6.26	5.99	2.72	3.54
377	.54	1.09	.00	.00	.00	.00	.00	.00
385	.00	.00	.00	.00	.00	.00	.00	.00
389	.00	.00	.00	.00	.00	.00	.00	.00
393	.00	.00	.00	.00	.00	.00	.00	.00
397	.00	.00	.00	.00	.54	.27	4.90	3.54

ROWF

RANGE	BIT#	RIGHT	LEFT
.05	6445	1.074	1.160
.15	9829	.923	.936
.25	12721	.954	.949
.35	15931	.830	.840
.45	20167	.800	.797
.55	41905	.833	.823
.65	45155	.945	.954
.75	48157	.911	.895
.85	51493	.911	.891
.95	54361	.991	.963
1.05	57727	.928	.911
1.15	61213	.887	.883
1.25	64093	.945	.936
1.35	67669	.945	.940
1.45	70639	.972	.967
1.55	73705	.794	.800
1.65	76441	.932	.923
1.75	80065	.813	.807
1.85	83491	.949	.949
1.95	87175	.876	.880
2.05	90031	.981	.958
2.15	92809	1.015	1.005
2.25	95977	.911	.895
2.35	99313	.861	.854
2.45	102553	.954	.936
2.55	105487	.928	.907
2.65	117919	.779	.767
2.75	121411	.868	.880
2.85	124291	.936	.928
2.95	130771	.536	.529
3.05	133735	.954	.923
3.15	137197	.891	.903
3.25	139795	.954	.932
3.35	142231	.981	.958
3.45	144847	.919	.932
3.55	148975	.940	.923
3.65	152425	.891	.887
3.75	155827	.972	.967
3.85	167569	.932	.932
3.95	171061	.972	.967
4.05	174949	.880	.865
4.15	179491	.724	.734
4.25	182623	.928	.895
4.35	198289	.936	.945
4.45	201475	.936	.932
4.55	205423	.813	.791
4.65	208879	.903	.895
4.75	212137	.991	.967

SCAN:48

ARROW - ROWFS
FROM
SEP304 - ARROW